

# **GP Titrino 736**

Series 01 ...

**Instructions for Use 8.736.1003**

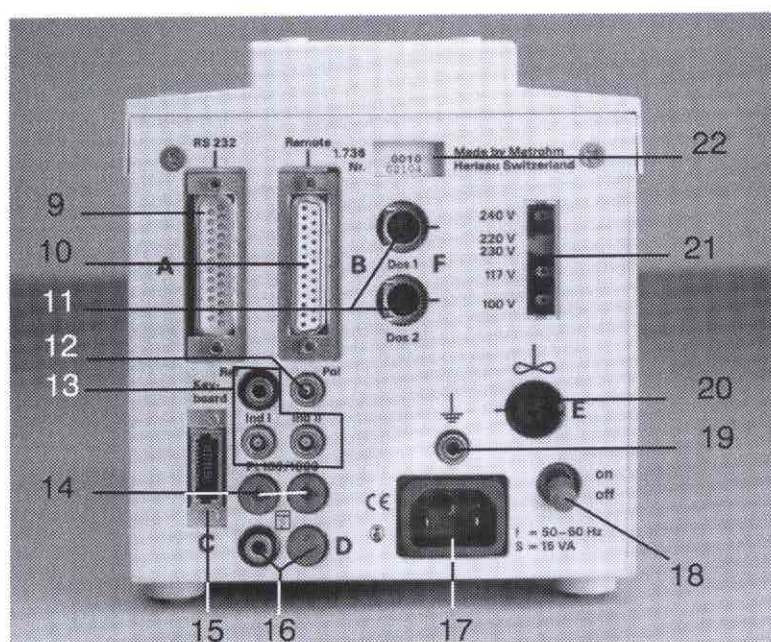
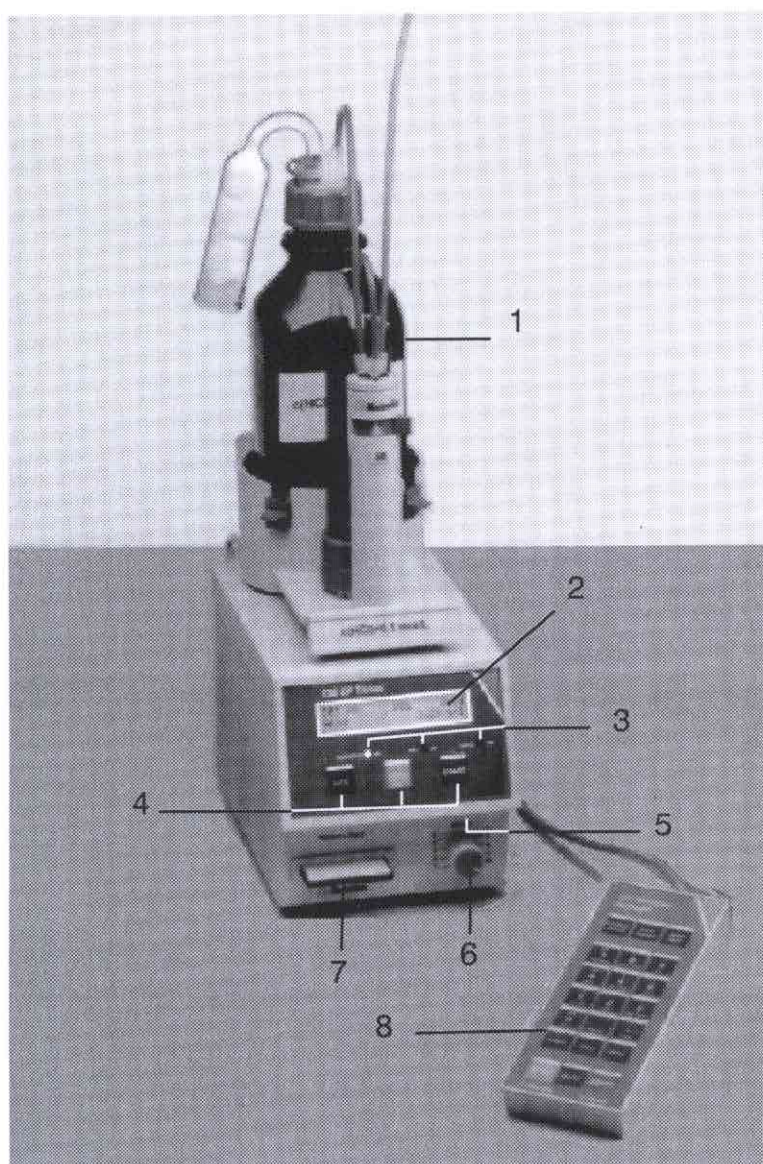
96.01 Ti/pr

# Instructions for Use of 736 GP Titrino

## Table of contentss

|                                                                       |     |
|-----------------------------------------------------------------------|-----|
| <b>1. Overview</b> .....                                              | 2   |
| <b>2. Manual operation</b> .....                                      | 4   |
| 2.1 Keypad .....                                                      | 4   |
| 2.2 Keys with rolling inquiries .....                                 | 5   |
| 2.3 Input of texts, keys > and < .....                                | 6   |
| 2.4 Configuration, key <configuration> .....                          | 7   |
| 2.5 Selection of the mode, key <mode> .....                           | 11  |
| 2.6 Parameters, key <parameters> .....                                | 12  |
| 2.6.1 Parameters for DET and MET .....                                | 12  |
| 2.6.2 Parameters for SET .....                                        | 22  |
| 2.6.3 Parameters for KFT .....                                        | 32  |
| 2.6.4 Parameters for STAT .....                                       | 42  |
| 2.6.5 Parameters for DOS .....                                        | 54  |
| 2.6.6 Parameters for DOC .....                                        | 61  |
| 2.6.7 Parameters for MEAS .....                                       | 68  |
| 2.6.8 Parameters for CAL .....                                        | 70  |
| 2.6.9 Parameters for TIP .....                                        | 72  |
| 2.7 Result calculations .....                                         | 74  |
| 2.8 Statistics calculation .....                                      | 76  |
| 2.9 Common variables .....                                            | 77  |
| 2.10 Data output .....                                                | 78  |
| 2.11 TIP, Titration Procedure .....                                   | 81  |
| 2.12 Method memory, keys <user meth> and <card> .....                 | 84  |
| 2.13 Calibration data, key <cal.data> .....                           | 88  |
| 2.14 Current sample data, key <smpl data> .....                       | 89  |
| 2.15 Silo memory for sample data .....                                | 90  |
| 2.16 Store determination results and silo calculations .....          | 93  |
| 2.17 Preparation of the titrating burets, keys <prep> and <DOS> ..... | 96  |
| <b>3. Operation via RS232 interface (green leaves)</b> .....          | 97  |
| 3.1 General rules .....                                               | 97  |
| 3.1.1 Call up of objects .....                                        | 98  |
| 3.1.2 Triggers .....                                                  | 99  |
| 3.1.3 Status and error messages .....                                 | 100 |
| 3.2 Remote control commands .....                                     | 106 |
| 3.2.1 Overview .....                                                  | 106 |
| 3.2.2 Description of the remote control commands .....                | 126 |
| 3.3 Characteristics of the RS232 interface .....                      | 155 |
| 3.3.1 Data transfer protocol .....                                    | 155 |
| 3.3.2 Handshake .....                                                 | 155 |
| 3.3.3 Pin assignment .....                                            | 159 |
| 3.4 What can you do, if the data transfer does not work? .....        | 161 |

|                                                                                          |     |
|------------------------------------------------------------------------------------------|-----|
| <b>4. Error messages, troubleshooting</b> .....                                          | 162 |
| 4.1 Error and special messages .....                                                     | 162 |
| 4.2 Diagnosis .....                                                                      | 166 |
| <br>                                                                                     |     |
| <b>5. Preparations</b> .....                                                             | 179 |
| 5.1 Setting up and connecting the instruments .....                                      | 179 |
| 5.1.1 Titrino with Magnetic Stirrer .....                                                | 179 |
| 5.1.2 Titrino with external burets .....                                                 | 180 |
| 5.1.3 Connection of a printer .....                                                      | 181 |
| 5.1.4 Connection of a balance .....                                                      | 182 |
| 5.1.5 Connection of a sample changer .....                                               | 183 |
| 5.1.6 Connection of a recorder .....                                                     | 184 |
| 5.1.7 Connection of a computer .....                                                     | 185 |
| 5.2 Installation of the titration vessel, connection of electrodes .....                 | 186 |
| 5.2.1 Setting up the titration vessel .....                                              | 186 |
| 5.2.2 Connection of the sensors .....                                                    | 187 |
| 5.3 Preparing the Exchange Unit .....                                                    | 188 |
| 5.3.1 Setting up the 6.3011.XXX...6.3014.XXX Exchange Units .....                        | 188 |
| 5.3.2 Assembly of the 6.3006.XXX/6.3007.XXX Exchange Units .....                         | 189 |
| 5.3.3 First-time filling .....                                                           | 189 |
| 5.3.4 Change the Exchange Unit .....                                                     | 189 |
| 5.3.5 Maintenance .....                                                                  | 190 |
| 5.3.6 Mounting the thermostat jacket of the 6.3011.XXX/6.3014.XXX<br>Exchange Unit ..... | 190 |
| 5.3.7 Micro model – 1 ml, 6.3006.113 .....                                               | 191 |
| <br>                                                                                     |     |
| <b>6. Appendix</b> .....                                                                 | 192 |
| 6.1 Technical specifications .....                                                       | 192 |
| 6.2 Pin assignment of the "Remote" socket .....                                          | 194 |
| 6.2.1 Lines of the "Remote" socket during titration .....                                | 196 |
| 6.3 Warranty and certificates .....                                                      | 198 |
| 6.4 Scope of delivery and ordering designations .....                                    | 201 |
| 6.4.1 736 GP Titrino .....                                                               | 201 |
| 6.4.2 Exchange Units .....                                                               | 204 |
| <br>                                                                                     |     |
| <b>Index</b> .....                                                                       | 209 |



# 1. Overview

## Front view of instrument:

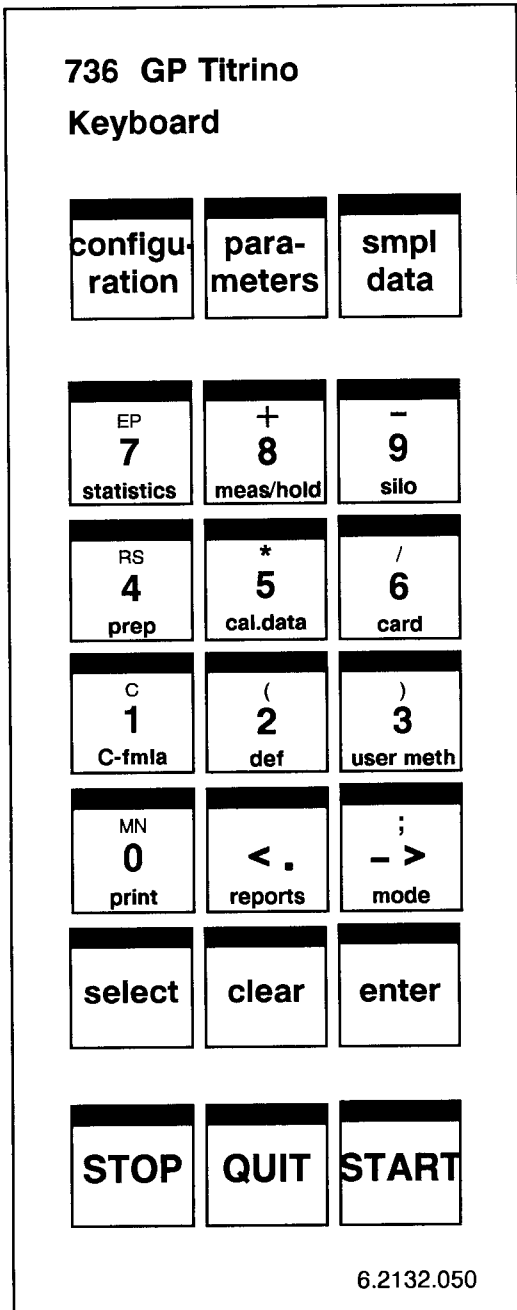
- 1 Exchange Unit
- 2 Display
- 3 **Indicator lamps**
  - "statistics on": Lamp is on when the "statistics" function (calculation of mean value and standard deviation) is switched on.
  - "silo on": Lamp is on when silo memory (for sample data) is switched on.
  - "cond.": Lamp flashes when conditioning is performed and the titration vessel is still wet. It is on if conditioning is ok.
- 4 **Control keys of Titrino**
  - DOS: Dispensing is performed as long as <DOS> is being pressed. The dosing element is being used, which was selected in the method. Used to prepare the Exchange Unit. The dispensing rate can be set with potentiometer © .
  - STOP/FILL: – Stops procedures, e.g. titration, conditioning.  
– Fill command after <DOS> to prepare the Exchange Unit. Identical to the <STOP> key of the separate keypad.
  - START: Starts procedures, e.g. titration, conditioning. Identical to the <START> key of the separate keypad.
- 5 Setting of the display contrast
- 6 Controlling of dosing rate during dosing with <DOS> and in subsequent filling
- 7 Opening for the memory card
- 8 Separate keypad

## Rear view of instrument:

- 9** **RS232 Interface**  
for the connection of a printer and balance or a computer
- 10** **Remote lines** (input/output)  
for the connection of a sample changer, robot, etc.
- 11** **Connection for external dosing elements D1 and D2**  
685 Dosimats or 700 Dosinos
- 12** **Connection for polarized electrodes**  
for measured quantities  $I_{pol}$  and  $U_{pol}$
- 13** **Connection for potentiometric electrodes**  
for measured quantities pH and U (voltage). 2 measuring inputs which can be used either separately or as a single differential potentiometric input for non-aqueous titrations, see also page 187.  
Important: If work is performed in the same measuring vessel with both measuring inputs, the same reference electrode must be used.
- 14** **Connection for temperature sensor**  
Pt100 or Pt1000
- 15** **Connection for the separate keypad**
- 16** **Analog output**  
for the connection of a recorder
- 17** **Mains connection**  
With mains supplies where the mains voltage is subject to severe HF disturbances, the Titrino should be operated via an additional mains filter, e.g. Metrohm 615 model.
- 18** **Mains switch**
- 19** **Earthing socket**  
The Titrino must be earthed properly and effectively, if need be via the earthing socket.
- 20** **Connection for 728 Magnetic Stirrer, 722 Rod Stirrer, 727 or 703 Ti Stand**  
Supply voltage: + 9 VDC ( $I \leq 200$  mA)
- 21** **Display of the set mains voltage**  
Before switching on the first time, check that the set mains voltage matches the voltage of your power supply. If this is not the case, disconnect mains cable and change voltage.
- 22** **Rating plate**  
with fabrication, series and instrument number

## 2. Manual operation

### 2.1 Keypad



- < configuration > : Configuration
- < parameters > : Parameters
- < smpl data > : Sample data
- < statistics > : On/off switching of statistics calculations of consecutive determinations (see page 76)
- < meas/hold > : On/off switching of
  - measurements between titrations
  - the hold function during titrations
- < silo > : On/off switching of the silo memory for sample data (see page 90ff)
- < prep > : Preselection of dosing element (see page 96)
- < cal.data > : Calibration data (see page 88)
- < card > : Functions of the memory card (see page 85f)
- < C-fmla > : Calculation constants (see page 75)
- < def > : Formulas, information for result output, sequence for TIP (see page 74ff)
- < user meth > : Method memory (see page 84)
- < print > : Printing of reports (see page 78)
- < reports > : Result output: < print > + < reports > + < enter >
- < mode > : Mode selection (see page 11)
- < select > :
  - selection of special input values, designated with ":" in the dialog
  - selection of result display
- < clear > :
  - clears entries
  - sets special values, e.g. "OFF"
- < enter > :
  - accepts values and advances rolling inquiries
  - branches to the individual inquiries of the inquiry groups ">"
  - closing of command sequences
- < STOP > : Stops methods
- < QUIT > : Exit from
  - rolling inquiries; leads to the next higher level
  - waiting times
  - printing
- < START > : Starts methods

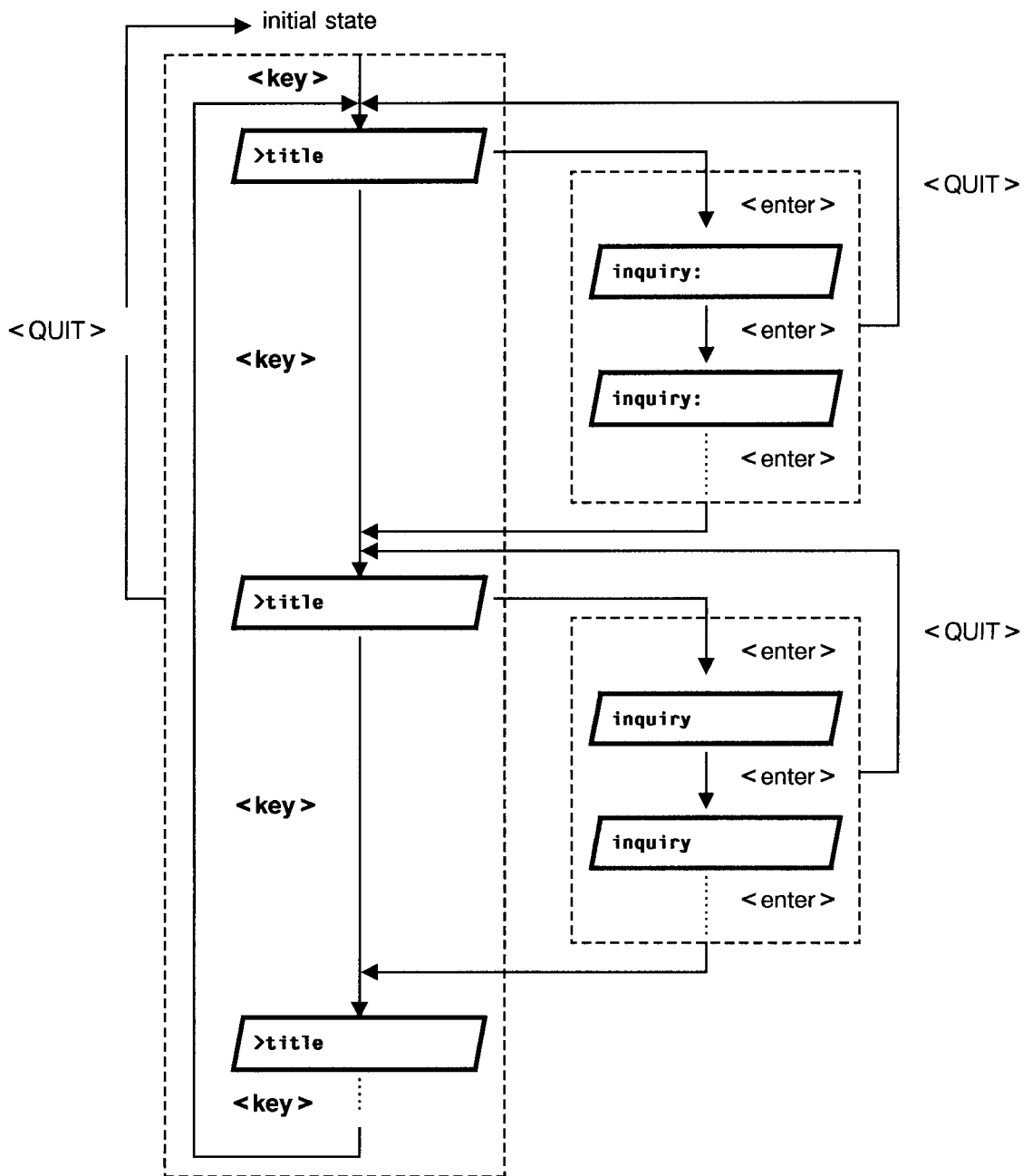
The third functions (topmost inscriptions) on the keys of the keypad are used for formula entry, see page 74.

## 2.2 Keys with rolling inquiries

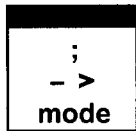
Inquiry keys are organised as rolling inquiries, i.e.

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

The organisation of the rolling inquiries is shown schematically below:



## 2.3 Input of texts, keys > and <



With > and < characters can be selected and texts written.

### Writing of texts

1. Press < for inputting a new text.
2. Select the blinking position. Move the characters with > and < until the desired character appears.
3. Confirm with <enter>.
4. Select the character for the next position and confirm with <enter>... etc.
5. If the text is ok and shorter than the whole writing space in the display (16, 10, 8, 6 or 5 characters), press <QUIT> to leave the text input, store with <enter> the text.  
If your text fills up the possible writing space, press just <enter> to store the text.
6. If you have made a spelling mistake, you can erase one position backwards by pressing <clear>. If you press repeatedly <clear>, one position after the other is cleared.

### Correction of stored texts

You can add characters to stored texts or correct them:

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

## 2.4 Configuration, key <configuration>

|                                                                                                                            |                                                                                                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <b>configu-<br/>ration</b> </div> | <p>&lt;configuration&gt; serves to enter device specific datas. The key is organised as a rolling inquiry. The set values apply to all modes. The values shown in the displays "<input type="text"/>" are the default values.</p> |
|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <b>&gt;peripheral units</b> </div>                           | <h3>Settings for peripheral units</h3>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <b>send to:                      IBM</b> </div>              | <p><i>Selection of printer (Epson, Seiko, Citizen, HP, IBM)</i><br/>         "Epson", for Epson<br/>         "Seiko", e.g. for DPU-411<br/>         "Citizen", e.g. for iDP 560 RS<br/>         "HP" e.g. for Desk Jet types. Place curves always at the beginning of a page as you cannot have them over 2 pages.<br/>         "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.</p>                            |
| <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <b>balance :                      Sartorius</b> </div>       | <p><i>Selection of balance (Sartorius, Mettler, Mettler AT, AND, Precisa)</i><br/>         Sartorius:    Models MP8, MC1<br/>         Mettler:      Models AM, PM and balances with 011, 012, and 016 interfaces<br/>         Mettler AT:   Model AT<br/>         AND:          Models ER-60, 120, 180, 182, FR-200, 300 and FX-200, 300, 320<br/>         Precisa:      Models with RS232C interface</p>                                                                                                     |
| <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <b>record:                                      U</b> </div> | <p><i>Selection of record at the analog output (U, dU/dt, V, dV/dt, U(rel), T).</i><br/>         U:                      Voltage<br/>         dU/dt:                Measuring value drift<br/>         V:                      Volume<br/>         dV/dt:                Volume drift with SET, STAT, DOC and KFT<br/>         U(rel):                Control deviation with SET, STAT, DOC and KFT<br/>         T:                      Temperature, if monitoring is on with STAT, DOS, DOC and MEAS T.</p> |

| <b>Auxiliaries</b>             | <b>General settings</b>                                                                                                                                                                                                                                          |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>dialog:</b> <b>english</b>  | <i>Selection of dialog language (english, deutsch, français, español, portuguese, italiano, svenska)</i>                                                                                                                                                         |
| <b>date</b> <b>1997-01-26</b>  | <i>Current date (YYYY-MM-DD)<br/>Format: Year-month-day, entry with leading zeros.</i>                                                                                                                                                                           |
| <b>time</b> <b>08:13</b>       | <i>Current time (HH-MM)<br/>Format: Hours-minutes, entry with leading zeros.</i>                                                                                                                                                                                 |
| <b>run number</b> <b>1</b>     | <i>Current run number for result output (0...9999)<br/>The sample number is set to 0 when the instrument is switched on and incremented on every determination.</i>                                                                                              |
| <b>auto start</b> <b>OFF</b>   | <i>Automatic starts of titrations. (1...9999, OFF)<br/>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.</i> |
| <b>start delay</b> <b>0 s</b>  | <i>Start delay (0...999 999 s)<br/>Delay time after start of methods. Abort with &lt;QUIT&gt;.</i>                                                                                                                                                               |
| <b>device label</b>            | <i>Individual identification of devices (up to 8 ASCII characters)<br/>Will be printed in the result report, see page 79.</i>                                                                                                                                    |
| <b>program</b> <b>736.0010</b> | <i>Display of program version</i>                                                                                                                                                                                                                                |

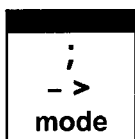
|                                        |                                                                                                                                                                |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>&gt;RS232 settings</b></p>       | <p><b>Settings of RS232 interface</b><br/>see page 155 - Characteristics of RS232 interface</p>                                                                |
| <p>baud rate: 9600</p>                 | <p>Baud rate (300, 600, 1200, 2400, 4800, 9600)</p>                                                                                                            |
| <p>data bit: 8</p>                     | <p>Data bit (7, 8)</p>                                                                                                                                         |
| <p>stop bit: 1</p>                     | <p>Stop bit (1, 2)</p>                                                                                                                                         |
| <p>parity: none</p>                    | <p>Parity (even, odd, none)</p>                                                                                                                                |
| <p>handshake: HwS</p>                  | <p>Handshake (HwS, HwF, SWline, SWchar, none)<br/>see page 155ff.</p>                                                                                          |
| <p>RS control: ON</p>                  | <p>Receiving of commands via RS (OFF, ON)<br/>"OFF" means that the receipt of commands via the RS232 interface is blocked. Data <u>output</u> is possible.</p> |
| <p><b>&gt;Common Variable</b></p>      | <p><b>Common variables</b></p>                                                                                                                                 |
| <p>C30<br/>etc.</p>                    | <p>Common variables C30...C39 (0... ± 999 999)<br/>The values of all common variables are displayed, see page 77.</p>                                          |
| <p><b>&gt;prep.dosing elements</b></p> | <p><b>Preparation of titration burets, "prep" and "empty"</b><br/>see page 96</p>                                                                              |
| <p>power ON prep.: OFF</p>             | <p>Warning after power ON (ON, OFF)<br/>If this function is on, a warning appears after switching on the Titrino, that a preparation should be executed.</p>   |
| <p>report: OFF</p>                     | <p>Report (ON, OFF)<br/>If ON, a report will be printed after prep.</p>                                                                                        |

|                                                                                                                    |                                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div style="border: 1px solid black; padding: 2px; display: inline-block;">dos.element: internal D0</div>          | <p>Selection of the dosing element (internal D0, external D1, external D2)<br/>         internal D0: buret of the Titrino<br/>         external D1/2: buret D1, D2, resp.</p>                                                                                        |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;">warn.interv.DX    OFF min</div>         | <p>Warning interval (5...9999 min, OFF)</p>                                                                                                                                                                                                                          |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;">dos.drive:            Dosimat</div>     | <p>Selection of the type of dosing element (Dosimat, Dosino)<br/>         The internal buret D0 reacts like a "Dosimat".</p>                                                                                                                                         |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;">volume DX            3.5 ml</div>       | <p><b>Parameters for the internal buret and for Dosimats:</b><br/>         Volume, that will be dosed with the preparation (0...99 999.99 ml)</p> <p>Number of cycles</p> <p>Dosing rate (0.01...150 ml/min, max.)</p> <p>Filling rate (0.01...150 ml/min, max.)</p> |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;">cycles DX            2</div>            |                                                                                                                                                                                                                                                                      |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;">dos.rate            max. ml/min</div>   |                                                                                                                                                                                                                                                                      |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;">fill rate.            max. ml/min</div> |                                                                                                                                                                                                                                                                      |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;">outlet:                tip</div>        | <p><b>Parameters for Dosinos:</b><br/>         Location, where liquid is expelled (tip, flask).<br/>         With "flask" the reagent will be reexpelled into the bottle. In this case, it is possible that the titer will be changed!</p>                           |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;">len.dos.tub.        40.0 cm</div>       | <p>Length of the dosing tube (1...999.9 cm)</p>                                                                                                                                                                                                                      |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;">diam.dos.tub.       2.0 mm</div>        | <p>Diameter of the dosing tube (0.1...9.9 mm)</p>                                                                                                                                                                                                                    |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;">len.asp.tub.        25.0 cm</div>       | <p>Length of the aspiration tube (1...999.9 cm)</p>                                                                                                                                                                                                                  |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;">diam.asp.tub.       2.0 mm</div>        | <p>Diameter of the aspiration tube (0.1...9.9 mm)</p>                                                                                                                                                                                                                |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;">dos.rate            max. ml/min</div>   | <p>Dosing rate (0.01...150 ml/min, max.)</p>                                                                                                                                                                                                                         |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;">fill rate            max. ml/min</div>  | <p>Filling rate (0.01...150 ml/min, max.)</p>                                                                                                                                                                                                                        |

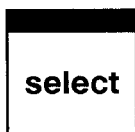
**Settings for the curve plot**

The curve plot can be varied in its length, width and appearance, see page 153.

## 2.5 Selection of the mode, key <mode>



Press key <mode> until the desired mode is displayed, press <enter>, select desired measured quantity with <select>, and confirm 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: **D**osing function with volume, time, or rate control.
- ▶ DOC: **D**osing **C**ontrolled by a measured value gradient.
- ▶ CAL: pH **C**alibration.
- ▶ MEAS: **M**easuring.
- ▶ TIP: **T**itration **P**rocedure. Linking of various commands and methods to a titration procedure.

These standard modes are equipped with a set of standard parameters. They only need few settings in order to be ready to work.

TIP is an empty "shell". The TIP sequence has to be defined with <def>, see page 81.

You will find a survey of the modes in the short Instructions for use, page 12.

## 2.6 Parameters, key < parameters >

|                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">para-<br/>meters</div> | <p>&lt;parameters&gt; is used for the entry of values that determine the titration. The key is organised as a rolling inquiry. 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. The values shown in the display "<input type="text"/>" are default values.</p> |
|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### 2.6.1 Parameters for DET and MET

| <b>&gt;titration parameters</b>                                                                               | <b>General titration parameters</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |      |      |           |       |           |       |           |       |            |
|---------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------|------|-----------|-------|-----------|-------|-----------|-------|------------|
| DET <input style="width: 150px; border: 1px solid black;" type="text" value="meas.pt.density 4"/>             | <i>Measuring point density (0...9)</i><br>0 means highest density, 9 lowest. Selection of the meas.pt.density, see page 18.                                                                                                                                                                                                                                                                                                                                                                                                                  |               |      |      |           |       |           |       |           |       |            |
| DET <input style="width: 150px; border: 1px solid black;" type="text" value="min.incr. 10.0 u1"/>             | <i>Minimum increment (0...999.9 uL)</i><br>The increment is dispensed at the beginning of the titration and in the region of the equivalence point.<br>If "min.incr." = 0, measured values are stored as a function of time.                                                                                                                                                                                                                                                                                                                 |               |      |      |           |       |           |       |           |       |            |
| MET <input style="width: 150px; border: 1px solid black;" type="text" value="V step 0.10 ml"/>                | <i>Size of volume increment (0...9.999 mL)</i><br>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 19. If "V step = 0", measured values are stored as a function of time.                                                                                                                                                                                                                                      |               |      |      |           |       |           |       |           |       |            |
| <input style="width: 150px; border: 1px solid black;" type="text" value="titr.rate max. ml/min"/><br>** titr. | <i>Dosing rate for volume increments (0.01...150 mL/min, max.)</i><br><clear> sets "max".<br>The maximum rate depends on the Exchange Unit: <table style="margin-left: 20px; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Exchange Unit</th> <th style="text-align: left;">max.</th> </tr> </thead> <tbody> <tr> <td>5 mL</td> <td>15 mL/min</td> </tr> <tr> <td>10 mL</td> <td>30 mL/min</td> </tr> <tr> <td>20 mL</td> <td>60 mL/min</td> </tr> <tr> <td>50 mL</td> <td>150 mL/min</td> </tr> </tbody> </table> | Exchange Unit | max. | 5 mL | 15 mL/min | 10 mL | 30 mL/min | 20 mL | 60 mL/min | 50 mL | 150 mL/min |
| 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 uA/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 form 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 18. 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**    0.00 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:*

| <i>Exchange Unit</i> | <i>max.</i> |
|----------------------|-------------|
| 5 mL                 | 15 mL/min   |
| 10 mL                | 30 mL/min   |
| 20 mL                | 60 mL/min   |
| 50 mL                | 150 mL/min  |

|                                        |                                                                                                                                                                                                                          |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>pause</b> 0 s</p>                | <p><i>Waiting time (0...999 999 s)</i><br/>Waiting time, e.g. for equilibration of the electrode after the start or reaction time after dosing of start volume. The delay time can be aborted with &lt;QUIT&gt;.</p>     |
| <p><b>dos.element: internal D0</b></p> | <p><i>Selection of the dosing element (internal D0, external D1, external D2)</i><br/>internal D0: internal buret of the Titrino<br/>external D1/2: buret D1, D2, resp.</p>                                              |
| <p><b>meas. input:</b> 1</p>           | <p><i>Measuring input for pH and U (1, 2, diff.)</i><br/>Request for measuring input for pH and U. Measuring input 1 or 2 or differential amplifier; connection of electrodes, see page 187.</p>                         |
| <p>I(pol) 1 uA</p>                     | <p>or</p> <p>With polarized electrodes, instead of the measuring input the <i>polarization current (-127...127 uA)</i></p>                                                                                               |
| <p>U(pol) 400 mV</p>                   | <p>or</p> <p>the <i>polarization voltage (-1270...1270 mV, in steps of 10 mV)</i> is inquired.</p>                                                                                                                       |
| <p><b>electrode test:</b> OFF</p>      | <p><i>Electrode test (OFF, ON)</i><br/>Test for polarized electrodes. Performed on changeover from the inactive standby state to a measurement. "OFF" means that the test is not performed.</p>                          |
| <p><b>temperature</b> 25.0 °C</p>      | <p><i>Titration temperature (-170.0...500.0 °C)</i><br/>The temperature is measured at the start of the titration, if a T sensor is connected. This parameter is used for temperature compensation in pH titrations.</p> |

>stop conditions

**Stop conditions for 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.

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 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 uA, 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 |

**>statistics**

**Statistics calculation**

Mean value, absolute and relative standard deviation, see also page 76.

**status:** OFF

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

**mean** n= 2

*Number n of single values for statistics (2...20)*

**res.tab:** original

*Result table for statistics calculation (original, delete n, delete all)*

"original": The original table is used.  
Deleted results are again incorporated in the evaluation.

"delete n": Deletion of single results with the index n.

"delete all": The entire table is deleted.

**delete** n= 1

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

**>evaluation**

**EP evaluation/recognition**

See page 18 ff.

**EPC** 5

*Equivalence point criterion (input range depends on mode).*

*For DET:*

*0...200*

*For MET:*

*pH: 0.10...9.99*

*U, I<sub>pol</sub>: 1...999 mV*

*U<sub>pol</sub>: 0.1...99.9 uA)*

Threshold for the size of the jump, see page 19.

**EP recognition** all

*Recognition of EP's which fulfil 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.

|                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>low limit 1 pH      -20.00</p> | <p>If "window" is selected, lower and upper limits of windows are inquired.<br/> <i>Lower limit of window 1</i><br/> and<br/> <i>upper limit of window 1</i><br/> <i>(Input ranges for both inquiries depend on the measured quantity):</i><br/> pH:      0... ± 20.00, OFF<br/> U, lpol:  0... ± 2000 mV, OFF<br/> Upol:    0... ± 200.0 uA, OFF)<br/> &lt;clear&gt; sets "OFF".<br/> 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 21.<br/> Window inquiries continue until the lower limit is set to "OFF". Up to 9 possible windows.<br/> Always set both limits to ≠ OFF for a valid window.</p> |
| <p>up limit 1 pH      20.00</p>   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <p>fix EP1 at pH      OFF</p>     | <p><i>Interpolation of volumes at fixed times (input range depends on the measured quantity):</i><br/> pH:      0... ± 20.00, OFF<br/> U, lpol:  0... ± 2000 mV, OFF<br/> Upol:    0... ± 200.0 uA, OFF)<br/> &lt;clear&gt; sets "OFF".<br/> If a fix end point has been set, the volume value for the input measured value is interpolated from the curve, see also page 21.<br/> The volume values are available as C5X. Fix EP's are inquired until "OFF" is set. Up to 9 fix EP's.</p>                                                                                                                                                                                                                            |
| <p>pK/HNP:            OFF</p>     | <p><i>Evaluation of pK or HNP (ON, OFF)</i><br/> pK evaluation in case of pH titrations and half neutralization potential for U, see page 21.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <p>&gt;preselections</p>          | <p><b>Preselections for the sequence</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <p>req.ident:          OFF</p>    | <p><i>Request of identifications after start of titration. (id1, id1 &amp; id2, all, OFF)</i><br/> After start, sample identifications can be inquired automatically: Only id1, id1 &amp; id2, all three id's or no inquiries.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <p>req.smpl size:      OFF</p>    | <p><i>Request of sample size after start of titration (value, unit, all, OFF)</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <p>activate pulse:    OFF</p>     | <p><i>Pulse output on I/O line "activate" (L6, pin 1) of the remote socket (ON, OFF)</i><br/> see page 194.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

## Titration sequence of DET and MET

|                                                             |                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <START>                                                     | After start, the activate pulse is output, then start delay time is attended.                                                                                                                                                                                                                                                                                     |
| (Output activating pulse)                                   | The temperature is measured (if a T sensor is connected), "req.ident" and "req.smpl size" are requested and the start conditions are executed: The start volume is dosed without measured value acquisition, the pause is attended.                                                                                                                               |
| (Start delay)                                               | During the titration the volume increments are dosed and after every increment a measured value is acquired.                                                                                                                                                                                                                                                      |
| (Inquiry of ident)                                          | The measured value acquisition is either drift controlled ("equilibrium titration") or a fixed equilibrated time. If you have not intentionally changed the equilibration time, it is calculated according to the formula:                                                                                                                                        |
| (Inquiry of sample size)                                    |                                                                                                                                                                                                                                                                                                                                                                   |
| (Start conditions)                                          | $\text{Equilibration time (in s)} = \frac{150}{\sqrt{\text{Drift} + 0.01}} + 5$                                                                                                                                                                                                                                                                                   |
| Titration:<br>Dispense increments<br>Acquire measured value | The criterion which is first met applies. This avoids "infinite" titrations. If you enter the equilibration time on your own, it is valid. If the parameter "signal drift" is set "OFF", the measured values are acquired after a fixed equilibration time. If "signal drift" and "equilibration time" are set "OFF", the measured value is acquired immediately. |
| Stop conditions                                             | In the case of stop conditions, the criterion which is first met applies.                                                                                                                                                                                                                                                                                         |
| Calculations                                                | Finally, the the calculations are carried out and the data output. If you have a printer connected, see page 78.                                                                                                                                                                                                                                                  |
| Data output                                                 |                                                                                                                                                                                                                                                                                                                                                                   |

## Reagent feeding and EP evaluation of DET

The reagent feeding of DET is similar to the controlling, a human being would apply executing 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.<br>A high number, i.e. low measuring density, on the other hand, allows a more rapid titration.<br>The standard value of 4 is suitable for most cases. |
| 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).<br>Use low minimum increments only, if small volumes of titrant consumption are expected, e.g. in microtitrations; otherwise unwanted equivalence points may arise.<br>The standard value of 10.0 uL is suitable for most cases.                                                                                          |

The EP's are evaluated according to a special METROHM procedure which is so sensitive that even weak equivalence points are determined correctly.

Parameter:

EPC

Equivalence Point Criteria.

The *preset* EPC is compared to the *found* ERC (Equivalence point Recognition Criteria) for each evaluated equivalence point. The ERC is given in the following reports: deriv (1<sup>st</sup> derivative), comb (combined titration and derivative curves) as well as in the mplist (measuring point list). 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.

Parameter:

V step

Volume increment.

A prerequisite for good accuracy is the correct size of the volume increments. A good value is given by  $V \text{ step} = 1/20 V_{EP}$  ( $V_{EP}$  = 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 localised 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 ( $\Delta_n$ ). The exact equivalence point is determined with an interpolation factor, which depends on the delta values before and after  $\Delta_n$ :

$$V_{EP} = V_0 + \rho \cdot \Delta V$$

$V_{EP}$ : EP volume

$V_0$ : Total dispensed volume before  $\Delta_n$

$\Delta V$ : Volume increment

$\rho$  : Interpolation factor (Fortuin)

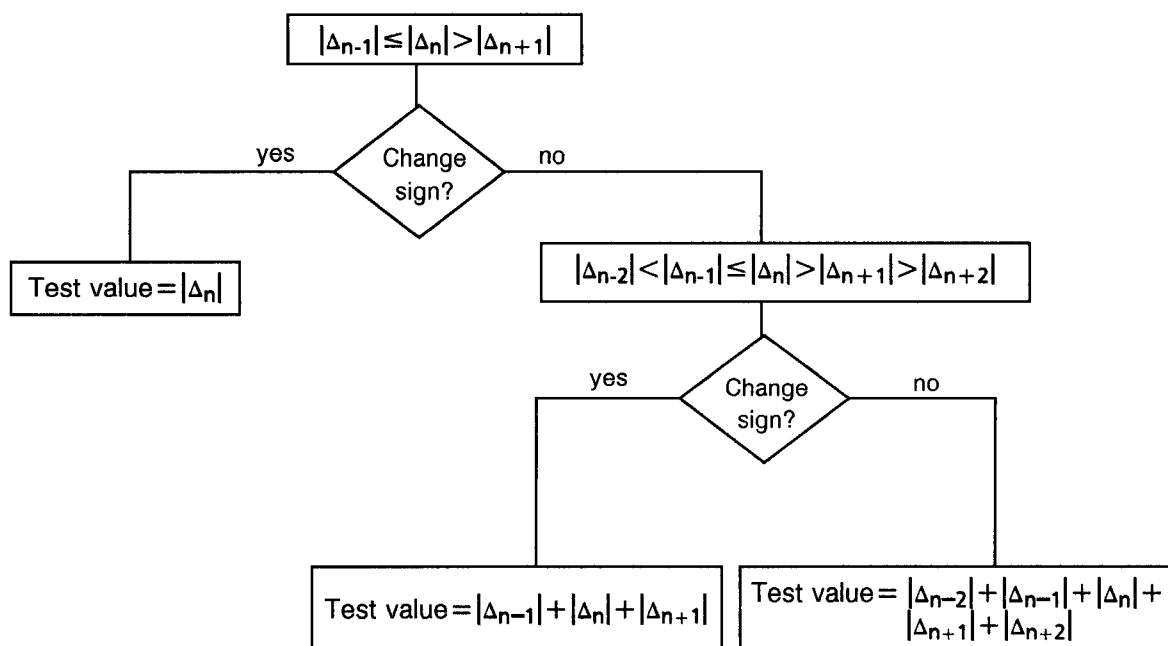
The evaluation can be repeated at any time after the titration in a "dry run" with changed evaluation criteria. The old titration data are not deleted until a new titration is started.

## EPC in MET

Its value is a measure of the size of the jump. For most cases, the default values suffice to suppress noise maxima and to recognise the actual jumps. The current test value of each jump is compared with the set value. The equivalence point is recognised only when the test value is larger than the set value. The test value of the EPC can be calculated as follows with the aid of the measuring point list:

- Search the greatest change in the measured value  $\rightarrow \Delta_n$
- Use the measured value changes before and after  $\Delta_n$  to set up the series  

$$\Delta_{n-2} \quad \Delta_{n-1} \quad \Delta_n \quad \Delta_{n+1} \quad \Delta_{n+2}$$
- Use the following scheme to decide how many  $\Delta$  values your series needs for the calculation of the test value:



- Enter a value for the parameter "EPC" somewhat higher than your calculated test value if you wish to suppress an EP. Conversely, if you wish to record a non-recognised EP, set a value for the "EPC" parameter somewhat less than the calculated test value.

## Selectable 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 can be selected (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.

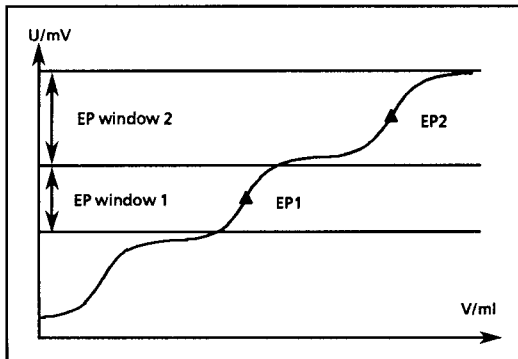
And finally you can set a "window" for each expected EP.

### 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 recognised; 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 recognised. Windows are defined on the measured value axis.



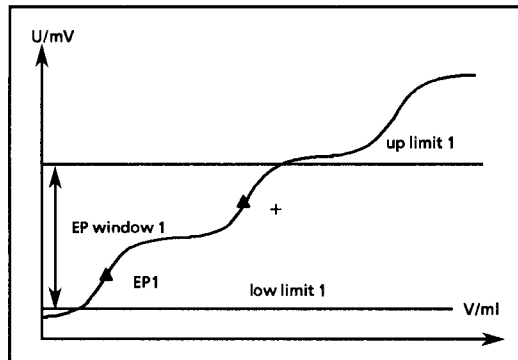
2 EP's are recognised. Their numbering is defined by the windows:

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 other.



The first jump is recognised as EP1, the second is not recognised. EP1 is marked as EP1 + to indicate that more than one EP has been found in the set 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:

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

When the activities  $a_B = a_A$ , then  $\text{pH} = \text{pK}$  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

$\text{pK} > 3.5$  due to the levelling effect of strong acids in aqueous solutions

$\text{pK} < 10.5$  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.

## 2.6.2 Parameters for SET

| >SET1                                                          | Control parameters for EP1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |      |      |           |       |           |       |           |       |            |
|----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------|------|-----------|-------|-----------|-------|-----------|-------|------------|
| <p><b>EP at pH</b>                      <b>OFF</b></p>         | <p><i>Preset EP1 (input range depends on the measured quantity):</i><br/> <i>pH: 0... ± 20.00, OFF</i><br/> <i>U, Ipol: 0... ± 2000 mV, OFF</i><br/> <i>Upol: 0... ± 200.0 uA, OFF)</i><br/>                     &lt;clear&gt; sets "OFF".<br/>                     If EP1 is "OFF", no further inquiries under SET1 appear.</p>                                                                                                                                                                                                                                                                                                                                            |               |      |      |           |       |           |       |           |       |            |
| <p><b>dynamics</b>                      <b>OFF</b></p>         | <p><i>Distance from EP where constant dosing should stop and controlling begins. (control range, input range depends on the measured quantity):</i><br/> <i>pH: 0.01...20.00, OFF</i><br/> <i>U, Ipol: 1...2000 mV, OFF</i><br/> <i>Upol: 0.1...200.0 uA, OFF)</i><br/>                     &lt;clear&gt; sets "OFF".<br/>                     "OFF" means largest control range, i.e. low titration.<br/>                     Outside the control range, dispensing is performed continuously, see also page 29.</p>                                                                                                                                                       |               |      |      |           |       |           |       |           |       |            |
| <p><b>max.rate</b>                      <b>10 ml/min</b></p>   | <p><i>Maximum dosing rate (0.01...150 mL/min, max.)</i><br/>                     &lt;clear&gt; sets "max.". This parameter determines primarily the addition rate outside the control range, see also page 29.<br/>                     The maximum rate depends on the Exchange Unit:</p> <table border="0" style="margin-left: 20px;"> <thead> <tr> <th style="text-align: left;">Exchange Unit</th> <th style="text-align: left;">max.</th> </tr> </thead> <tbody> <tr> <td>5 mL</td> <td>15 mL/min</td> </tr> <tr> <td>10 mL</td> <td>30 mL/min</td> </tr> <tr> <td>20 mL</td> <td>60 mL/min</td> </tr> <tr> <td>50 mL</td> <td>150 mL/min</td> </tr> </tbody> </table> | Exchange Unit | max. | 5 mL | 15 mL/min | 10 mL | 30 mL/min | 20 mL | 60 mL/min | 50 mL | 150 mL/min |
| Exchange Unit                                                  | max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |      |      |           |       |           |       |           |       |            |
| 5 mL                                                           | 15 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |      |      |           |       |           |       |           |       |            |
| 10 mL                                                          | 30 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |      |      |           |       |           |       |           |       |            |
| 20 mL                                                          | 60 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |      |      |           |       |           |       |           |       |            |
| 50 mL                                                          | 150 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |      |      |           |       |           |       |           |       |            |
| <p><b>min.rate</b>                      <b>25.0 uL/min</b></p> | <p><i>Minimum dosing rate (0.01...999.9 uL/min)</i><br/>                     This parameter determines the addition rate right at the start and the end of the titration, see also page 29.<br/>                     This parameter influences the titration speed and therefore its accuracy very strongly: A smaller min.rate results in a slower titration.</p>                                                                                                                                                                                                                                                                                                          |               |      |      |           |       |           |       |           |       |            |

|                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>stop crit:      drift</b></p>        | <p>Type of stop criteria (drift, time)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <p>** titr.</p>                            | <p>Titration stops if stop drift is reached. (1...999 uL/min)</p>                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <p><b>stop drift      20 uL/min</b></p>    | <p>Titration stops if there is no dosing during t(delay). (0...999 s, INF)</p>                                                                                                                                                                                                                                                                                                                                                                                                         |
| <p>** titr.</p>                            | <p>&lt; clear &gt; sets "INF"</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <p><b>t(delay)              10 s</b></p>   | <p>Switch off when the end point is reached and the set time after the last dispensing has elapsed.</p>                                                                                                                                                                                                                                                                                                                                                                                |
| <p>** titr.</p>                            | <p>If "INF" is set, an inquiry regarding the stop time appears.</p>                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <p><b>stop time              OFF s</b></p> | <p>Stop after a time (0...999 999 s, OFF)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <p>** titr.</p>                            | <p>&lt; clear &gt; sets "OFF".<br/>Stop after expiry of the set time after the start of the titration. "OFF" means no stop, i.e. titration for an "infinitely" long time.</p>                                                                                                                                                                                                                                                                                                          |
| <p><b>&gt;SET2</b></p>                     | <p><b>Parameters for EP2. Identical to EP1.</b><br/>They are identical to those under SET1.</p>                                                                                                                                                                                                                                                                                                                                                                                        |
| <p><b>&gt;titration parameters</b></p>     | <p><b>General titration parameters</b><br/>Apply globally for the entire titration.</p>                                                                                                                                                                                                                                                                                                                                                                                                |
| <p><b>titr.direction:      auto</b></p>    | <p>Direction is set automatically (+, -, auto)<br/>           auto:    The direction is set automatically by the Titrino (sign [U<sub>first</sub> - EP]).<br/>           +:        Direction of higher pH, higher voltage (more "positive"), larger currents.<br/>           -:        Direction of lower pH, lower voltage, smaller currents.<br/>           The titration direction is fixed if two EP's are set. In this case, an input for titration direction has no meaning.</p> |
| <p><b>pause 1              0 s</b></p>     | <p>Pause 1 (0...999 999 s)<br/>Waiting time before start volume, e.g. for equilibration of the electrode after the start. The waiting time can be aborted with &lt;QUIT&gt;.</p>                                                                                                                                                                                                                                                                                                       |
| <p>** titr.</p>                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

|                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                             |               |      |      |           |       |           |       |           |       |            |
|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------|------|-----------|-------|-----------|-------|-----------|-------|------------|
| <p><b>start V:</b>                    <b>OFF</b></p>                      | <p><i>Type of start volume (OFF, abs., rel.)</i><br/>"OFF": start volume switched off<br/>"abs.": absolute start volume in mL<br/>"rel.": relative start volume to sample size.</p>                                                                                                                                                                                                                         |               |      |      |           |       |           |       |           |       |            |
| <p><b>start V</b>                    <b>0.00 ml</b></p>                   | <p>If "abs." is set:<br/><i>Absolute start volume (0...999.99 mL)</i></p>                                                                                                                                                                                                                                                                                                                                   |               |      |      |           |       |           |       |           |       |            |
| <p><b>factor</b>                    <b>0</b></p>                          | <p>If "rel." is set:<br/><i>Factor for relative start volume (0... ± 999 999).</i><br/>Calculated as:<br/>start V in mL = factor * sample size</p>                                                                                                                                                                                                                                                          |               |      |      |           |       |           |       |           |       |            |
| <p><b>dos.rate</b>                <b>max. ml/min</b><br/><br/>**titr.</p> | <p><i>Dosing rate for start volume</i><br/><i>(0.01...150 mL/min, max.)</i><br/>&lt;clear&gt; sets "max."<br/>The maximum rate depends on the Exchange Unit:</p> <table border="0"><tr><td>Exchange Unit</td><td>max.</td></tr><tr><td>5 mL</td><td>15 mL/min</td></tr><tr><td>10 mL</td><td>30 mL/min</td></tr><tr><td>20 mL</td><td>60 mL/min</td></tr><tr><td>50 mL</td><td>150 mL/min</td></tr></table> | Exchange Unit | max. | 5 mL | 15 mL/min | 10 mL | 30 mL/min | 20 mL | 60 mL/min | 50 mL | 150 mL/min |
| Exchange Unit                                                             | max.                                                                                                                                                                                                                                                                                                                                                                                                        |               |      |      |           |       |           |       |           |       |            |
| 5 mL                                                                      | 15 mL/min                                                                                                                                                                                                                                                                                                                                                                                                   |               |      |      |           |       |           |       |           |       |            |
| 10 mL                                                                     | 30 mL/min                                                                                                                                                                                                                                                                                                                                                                                                   |               |      |      |           |       |           |       |           |       |            |
| 20 mL                                                                     | 60 mL/min                                                                                                                                                                                                                                                                                                                                                                                                   |               |      |      |           |       |           |       |           |       |            |
| 50 mL                                                                     | 150 mL/min                                                                                                                                                                                                                                                                                                                                                                                                  |               |      |      |           |       |           |       |           |       |            |
| <p><b>pause 2</b>                    <b>0 s</b><br/><br/>** titr.</p>     | <p><i>Pause 2 (0...999 999 s)</i><br/>Waiting time after start volume, e.g. reaction time after dosing of a start volume. The waiting time can be aborted with &lt;QUIT&gt;.</p>                                                                                                                                                                                                                            |               |      |      |           |       |           |       |           |       |            |
| <p><b>extr. time</b>                <b>0 s</b></p>                        | <p><i>Extraction time (0...999 999 s)</i><br/>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 &lt;QUIT&gt;.</p>                                                                                                                                             |               |      |      |           |       |           |       |           |       |            |
| <p><b>dos.element: internal D0</b></p>                                    | <p><i>Selection of dosing element (internal D0, external D1, external D2)</i><br/>internal D0: internal buret of the Titrino<br/>external D1/2: buret D1, D2, resp.</p>                                                                                                                                                                                                                                     |               |      |      |           |       |           |       |           |       |            |

**meas. input:** 1

or

**I(pol)** 1  $\mu$ A

or

**U(pol)** 400 mV

**electrode test:** OFF

*Measuring input (1, 2, diff.)*

Inquiry only with measured quantities pH and U. Measuring input 1 or 2 or differential amplifier; connection of electrodes, see page 119.

With polarized electrodes, instead of the measuring input the

*polarization current (-127...127  $\mu$ A)*

or the

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

is inquired.

*Electrode test (OFF, ON)*

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

**temperature** 25.0 °C

*Titration temperature (-170.0...500.0°C)*

Temperature is measured at the start of the titration if a T sensor is connected.

This parameter is used for temperature compensation in pH titrations.

| <p><b>&gt;stop conditions</b></p>           | <p><b>Stop conditions for titration</b><br/>If this is not "normal", i.e. after reaching the EP.</p>                                                                                                                                                                                                                                                                                                                                                     |               |      |      |           |       |           |       |           |       |            |
|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------|------|-----------|-------|-----------|-------|-----------|-------|------------|
| <p>stop V: abs.<br/>**titr.</p>             | <p>Type of stop volume (abs., rel., OFF)<br/>"abs.": absolute stop volume in mL.<br/>"rel.": relative stop volume to sample size.<br/>"OFF": stop volume switched off. Stop volume is not monitored.</p>                                                                                                                                                                                                                                                 |               |      |      |           |       |           |       |           |       |            |
| <p>stop V 99.99 ml<br/>**titr.</p>          | <p>If "abs." is set:<br/>Absolute stop volume (0...9999.99 mL)</p>                                                                                                                                                                                                                                                                                                                                                                                       |               |      |      |           |       |           |       |           |       |            |
| <p>factor 999999<br/>**titr.</p>            | <p>If "rel." is set:<br/>Factor for relative stop volume (0... ± 999 999)<br/>Calculated as:<br/>Stop V in mL = factor * sample size</p>                                                                                                                                                                                                                                                                                                                 |               |      |      |           |       |           |       |           |       |            |
| <p>filling rate max. ml/min<br/>**titr.</p> | <p>Filling rate after the titration<br/>(0.01...150 mL/min, max.)<br/>&lt;clear&gt; sets "max."<br/>The maximum rate depends on the Exchange Unit:</p> <table border="0"> <thead> <tr> <th>Exchange Unit</th> <th>max.</th> </tr> </thead> <tbody> <tr> <td>5 mL</td> <td>15 mL/min</td> </tr> <tr> <td>10 mL</td> <td>30 mL/min</td> </tr> <tr> <td>20 mL</td> <td>60 mL/min</td> </tr> <tr> <td>50 mL</td> <td>150 mL/min</td> </tr> </tbody> </table> | Exchange Unit | max. | 5 mL | 15 mL/min | 10 mL | 30 mL/min | 20 mL | 60 mL/min | 50 mL | 150 mL/min |
| Exchange Unit                               | max.                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |      |      |           |       |           |       |           |       |            |
| 5 mL                                        | 15 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |      |      |           |       |           |       |           |       |            |
| 10 mL                                       | 30 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |      |      |           |       |           |       |           |       |            |
| 20 mL                                       | 60 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |      |      |           |       |           |       |           |       |            |
| 50 mL                                       | 150 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |      |           |       |           |       |           |       |            |
| <p><b>&gt;statistics</b></p>                | <p><b>Statistics calculation</b><br/>Mean value, absolute and relative standard deviation, see also page 76.</p>                                                                                                                                                                                                                                                                                                                                         |               |      |      |           |       |           |       |           |       |            |
| <p>status: OFF<br/>*cond.</p>               | <p>Status of statistics calculation (OFF, ON).<br/>If the statistics calculation is switched off, the following inquiries regarding the statistics do not appear.</p>                                                                                                                                                                                                                                                                                    |               |      |      |           |       |           |       |           |       |            |
| <p>mean n= 2<br/>*cond.</p>                 | <p>Mean value calculation from n single results (2...20)</p>                                                                                                                                                                                                                                                                                                                                                                                             |               |      |      |           |       |           |       |           |       |            |

**res. tab: original**

\*cond.

Result table for the statistics calculation (original, delete n, delete all)

- "original": The original table is used. Deleted results are again incorporated in the evaluation.
- "delete n": Delete of single results with the index n.
- "delete all": The entire table is deleted.

**delete n= 1**

\*cond.

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

**>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 ul/min**

\*cond.

Value for manual drift correction (0...99.9 ul/min)

**req. ident: OFF**

Request of identifications after start of titration (id1, id1 & id2, all, OFF)

After start, sample identifications can be requested automatically: Only id1, id1 & id2, all three id's or no inquiries.

**req. smp1 size: OFF**

Request of sample size after start of titration (value, unit, all, OFF)

"all" the value and the unity will be requested.

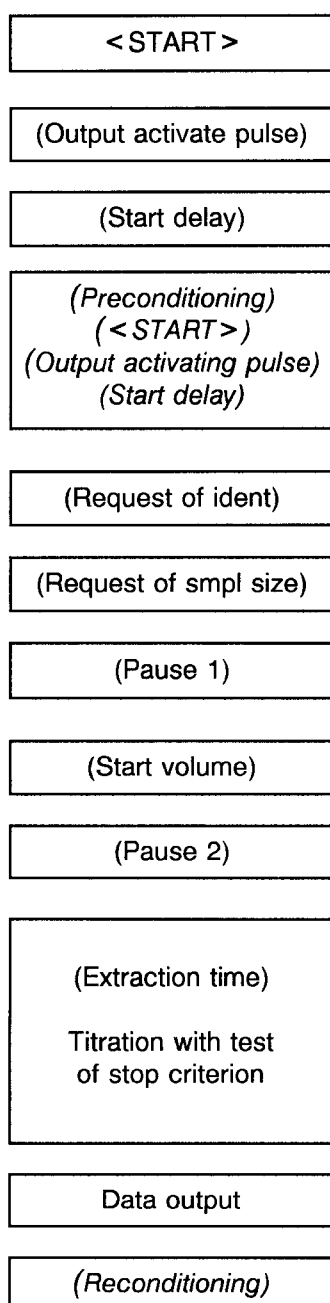
**activate pulse: OFF**

Pulse output on I/O line 6 (L6, pin 1) of the remote socket (first, all, cond., OFF)  
see page 194.

## Titration sequence of SET

The titration sequence may be configured to match your particular application. The following parameters determine the titration sequence (see diagram below):

- Start delay
- Conditioning (on, off)
- Request of sample identifications and sample size after start of titration
- Pause 1
- Start volume
- Pause 2
- Extraction time



Right after start, the activate pulse is transmitted (possibilities to activate pulse, see page 197) and the start delay time is processed, see page 22.

If *conditioning* is switched on, the titrant is dispensed to the sample solution to reach the (1st) end point. When conditioning is completed, the display shows, e.g.

```
/SET pH conditioning/  
or  
/drift ok 2.3 µl/min/
```

if the drift display is switched on. In this case, the current volume drift is also displayed during conditioning.

The instrument is now ready for titration. Press <START> .

After start of titration, the activate pulse is transmitted and the start delay time is processed.

The temperature is measured (if a T sensor is connected), and *id#1*, *id#2* and *sml size* are requested.

Furthermore the pause 1 will be attended and afterwards the start volume will be added. During dosing of start volume, no control is exerted.

The pause 2 will be attended and the titration of the EP1 and EP2 are executed.

If after reaching the EP2 the extraction time is not runned, the titration will be terminated only after finishing the extraction time.

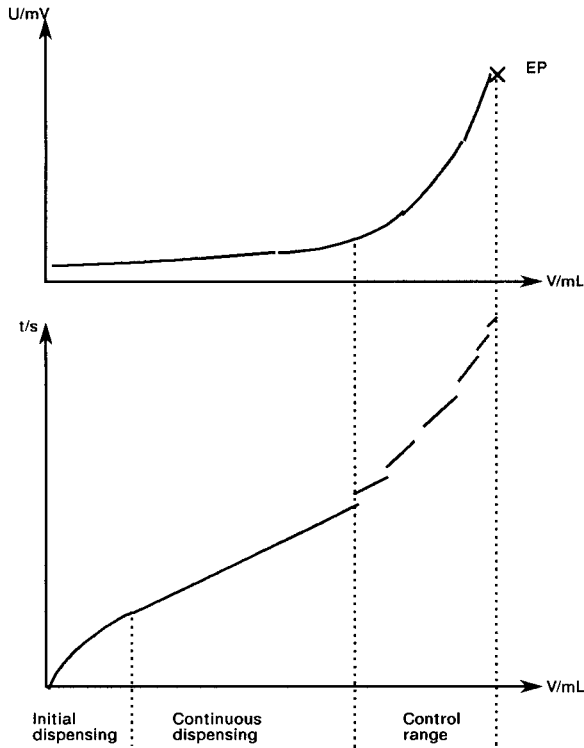
At the end of titration, the data are displayed and, if a printer is connected, a specified report is printed out (see also page 78).

After the titration, the titration vessel will be conditioned (to EP1) if conditioning is switched on.

## 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:

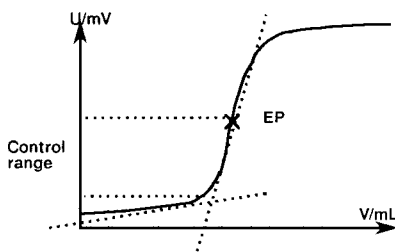


- 1) Initial dosing:  
Here the dosing rate increases constantly. It starts at the set "min.rate" and continues up to the allowed "max.rate".
- 2) Continuous dosing:  
Dosing is performed at the maximum rate "max.rate" until the control range (dynamics) is reached.
- 3) Dynamics (control range)  
In this range, dosing is performed in single steps. The last dosing steps are controlled by the "min.rate" parameter.

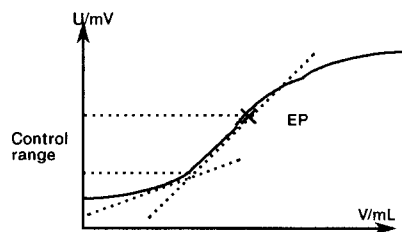
### Trial settings for the size of the control range

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

"steep" curves



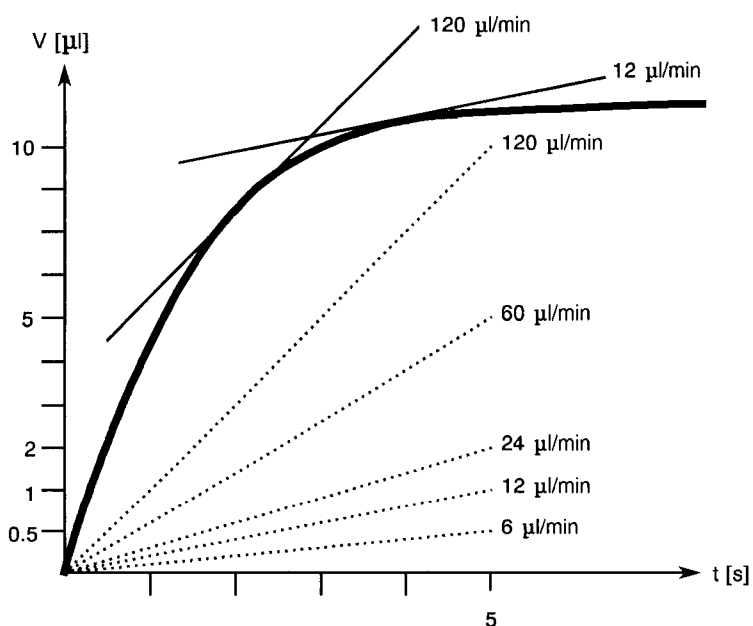
"flat" curves



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

The stop criterion "time",  $t(\text{delay})$ , 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  $2\mu\text{L}$ . With a  $t(\text{delay}) = 5\text{ s}$ , the last  $2\mu\text{L}$  reagent must thus suffice for 5 s or longer. This results in a drift of  $\leq 2\mu\text{L}/5\text{ s} = 24\mu\text{L}/\text{min}$  (the drift can be less than  $24\mu\text{L}/\text{min}$  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  $t(\text{delay}) = 5\text{ s}$ , you can set a value of  $\leq 24\mu\text{L}/\text{min}$  as stop drift. The following Table shows several values for the maximum stop drift.

| min. increment (Exchange Unit) \ t(delay) | 5 s                         | 10 s                        | 20 s                         |
|-------------------------------------------|-----------------------------|-----------------------------|------------------------------|
| 0.5 $\mu\text{l}$ (5 mL)                  | 6 $\mu\text{l}/\text{min}$  | 3 $\mu\text{l}/\text{min}$  | 1.5 $\mu\text{l}/\text{min}$ |
| 1 $\mu\text{l}$ (10 mL)                   | 12 $\mu\text{l}/\text{min}$ | 6 $\mu\text{l}/\text{min}$  | 3 $\mu\text{l}/\text{min}$   |
| 2 $\mu\text{l}$ (20 mL)                   | 24 $\mu\text{l}/\text{min}$ | 12 $\mu\text{l}/\text{min}$ | 6 $\mu\text{l}/\text{min}$   |
| 5 $\mu\text{l}$ (50 mL)                   | 60 $\mu\text{l}/\text{min}$ | 30 $\mu\text{l}/\text{min}$ | 15 $\mu\text{l}/\text{min}$  |



Same  $t(\text{delay})$  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 end point and the control range (dynamics), the default values for the other control parameters should suffice for the first titration. If you encounter difficulties in optimizing your titration, the following table will be of use:

**How to proceed if ...**

| Problem                                                                                 | Possible causes and corrective measures                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dosing at the end too long and with too small increments. "Never ends!"                 | <ul style="list-style-type: none"> <li>- Increase "min.rate". Perform an experiment with a much higher min.rate.</li> <li>- Change switch-off criterion. Attempt, e.g. to increase the stop drift or use a shorter t(delay) as stop criterion.</li> <li>- Possibly pass an inert gas through the titration vessel.</li> </ul>            |
| "Overshoots". Titration is not controlled, i.e. at the end single pulses are not dosed. | <ul style="list-style-type: none"> <li>- Lower "max.rate".</li> <li>- Set larger control range.</li> <li>- Set "min.rate" much lower.</li> <li>- Optimize arrangement of electrode and buret tip and improve stirring, see page 186. This is particularly important with very fast titration reactions and with steep curves.</li> </ul> |
| Titration time is too long.                                                             | <ul style="list-style-type: none"> <li>- Set higher "min.rate".</li> <li>- Set higher "max.rate".</li> <li>- Lower "dynamics".</li> </ul>                                                                                                                                                                                                |
| Scatter in titration results is too great.                                              | <ul style="list-style-type: none"> <li>- Set "min.rate" lower.</li> </ul>                                                                                                                                                                                                                                                                |

## 2.6.3 Parameters for KFT

| <p>&gt;titration parameters</p> | <p><b>General titration parameters</b><br/>Apply globally for the entire titration.</p>                                                                                                                                                                                                                           |               |      |      |           |       |           |       |           |       |            |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------|------|-----------|-------|-----------|-------|-----------|-------|------------|
| <p>titr.direction: -</p>        | <p><i>Direction is set automatically (+, -, auto)</i><br/>                     auto: The direction is set automatically by the Titrino.<br/>                     +: Direction of higher voltage (more "positive"), larger currents.<br/>                     -: Direction of lower voltage, smaller currents.</p> |               |      |      |           |       |           |       |           |       |            |
| <p>titr.direction: +</p>        |                                                                                                                                                                                                                                                                                                                   |               |      |      |           |       |           |       |           |       |            |
| <p>pause 1 0 s</p>              | <p><i>Waiting time before start volume (0..999 999 s)</i><br/>                     Waiting time, e.g. for equilibration of the electrode after start. The equilibration time can be aborted with &lt;QUIT&gt;, see page 38.</p>                                                                                   |               |      |      |           |       |           |       |           |       |            |
| <p>** titr.</p>                 |                                                                                                                                                                                                                                                                                                                   |               |      |      |           |       |           |       |           |       |            |
| <p>start V: OFF</p>             | <p><i>Type of start volume (OFF, abs., rel.)</i><br/>                     "OFF": start volume switched off<br/>                     "abs.": absolute start volume in mL<br/>                     "rel.": relative start volume to sample size.</p>                                                                |               |      |      |           |       |           |       |           |       |            |
| <p>start V 0.00 ml</p>          | <p>If "abs." is set:<br/> <i>Absolute start volume (0...999.99 mL)</i></p>                                                                                                                                                                                                                                        |               |      |      |           |       |           |       |           |       |            |
| <p>factor 0</p>                 | <p>If "rel." is set:<br/> <i>Factor for relative start volume (0... ± 999 999).</i><br/>                     Calculated as:<br/>                     start V in mL = factor * sample size</p>                                                                                                                     |               |      |      |           |       |           |       |           |       |            |
| <p>dos.rate. max. ml/min</p>    | <p><i>Dosing rate for start volume (0.01...150 mL/min, max.)</i><br/>                     &lt;clear&gt; sets "max."<br/>                     The maximum rate depends on the Exchange Unit:</p>                                                                                                                   |               |      |      |           |       |           |       |           |       |            |
| <p>**titr.</p>                  | <table border="0"> <thead> <tr> <th>Exchange Unit</th> <th>max.</th> </tr> </thead> <tbody> <tr> <td>5 mL</td> <td>15 mL/min</td> </tr> <tr> <td>10 mL</td> <td>30 mL/min</td> </tr> <tr> <td>20 mL</td> <td>60 mL/min</td> </tr> <tr> <td>50 mL</td> <td>150 mL/min</td> </tr> </tbody> </table>                 | Exchange Unit | max. | 5 mL | 15 mL/min | 10 mL | 30 mL/min | 20 mL | 60 mL/min | 50 mL | 150 mL/min |
| Exchange Unit                   | max.                                                                                                                                                                                                                                                                                                              |               |      |      |           |       |           |       |           |       |            |
| 5 mL                            | 15 mL/min                                                                                                                                                                                                                                                                                                         |               |      |      |           |       |           |       |           |       |            |
| 10 mL                           | 30 mL/min                                                                                                                                                                                                                                                                                                         |               |      |      |           |       |           |       |           |       |            |
| 20 mL                           | 60 mL/min                                                                                                                                                                                                                                                                                                         |               |      |      |           |       |           |       |           |       |            |
| 50 mL                           | 150 mL/min                                                                                                                                                                                                                                                                                                        |               |      |      |           |       |           |       |           |       |            |
| <p>pause 2 0 s</p>              | <p><i>Waiting time after start volume (0...999 999 s)</i><br/>                     Second waiting time, e.g. reaction time after dosing of a start volume. The waiting time can be aborted with &lt;QUIT&gt;, see page 38.</p>                                                                                    |               |      |      |           |       |           |       |           |       |            |
| <p>** titr.</p>                 |                                                                                                                                                                                                                                                                                                                   |               |      |      |           |       |           |       |           |       |            |
| <p>extr.time 0 s</p>            | <p><i>Extraction time (0..999 999 s)</i><br/>                     During the extraction time no dosing occurs but the titration does not stop. The extraction time can be aborted with &lt;QUIT&gt;, see page 38.</p>                                                                                             |               |      |      |           |       |           |       |           |       |            |
| <p>** titr.</p>                 |                                                                                                                                                                                                                                                                                                                   |               |      |      |           |       |           |       |           |       |            |

|                                        |                                                                                                                                                                                                                                                                           |               |      |      |           |       |           |       |           |       |            |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------|------|-----------|-------|-----------|-------|-----------|-------|------------|
| <p><b>dos.element: internal D0</b></p> | <p><i>Selection of dosing element (internal D0, external D1/ D2)</i><br/>         internal D0: internal buret of the Titrimo<br/>         external D1/2: Buret D1, D2, resp.</p>                                                                                          |               |      |      |           |       |           |       |           |       |            |
| <p><b>I(pol) 1 µA</b></p>              | <p><i>Polarization current (-127...127 µA)</i></p>                                                                                                                                                                                                                        |               |      |      |           |       |           |       |           |       |            |
| <p>or</p>                              |                                                                                                                                                                                                                                                                           |               |      |      |           |       |           |       |           |       |            |
| <p><b>U(pol) 400 mV</b></p>            | <p>or the<br/> <i>polarization potential (-1270...1270 mV, in steps of 10 mV) is inquired.</i></p>                                                                                                                                                                        |               |      |      |           |       |           |       |           |       |            |
| <p><b>electrode test: OFF</b></p>      | <p><i>Electrode test (OFF, ON)</i><br/>         Test for polarized electrodes. Performed on changeover from the inactive standby state to a measurement. "OFF" means that the test is not performed.</p>                                                                  |               |      |      |           |       |           |       |           |       |            |
| <p><b>Temperatur 25.0 °C</b></p>       | <p><i>Titration temperature (-170.0...500.0°C).</i><br/>         The temperature is measured at the start of the titration if a T sensor is connected.</p>                                                                                                                |               |      |      |           |       |           |       |           |       |            |
| <p><b>&gt;control parameters</b></p>   | <p><b>Control parameters</b></p>                                                                                                                                                                                                                                          |               |      |      |           |       |           |       |           |       |            |
| <p><b>EP at U 250 mV</b></p>           | <p><i>Endpoint, controlpoint: This value is kept constant. (input range depending on the measured quantity:</i></p>                                                                                                                                                       |               |      |      |           |       |           |       |           |       |            |
| <p>** titr.</p>                        |                                                                                                                                                                                                                                                                           |               |      |      |           |       |           |       |           |       |            |
| <p>or</p>                              | <p><i>U, Ipol: 0... ± 2000 mV<br/>         I, Upol: 0... ± 200.0 µA)</i></p>                                                                                                                                                                                              |               |      |      |           |       |           |       |           |       |            |
| <p><b>EP at I 25.0 µA</b></p>          | <p><i>Controlling range. (control range, input range depends on the measured quantity:</i></p>                                                                                                                                                                            |               |      |      |           |       |           |       |           |       |            |
| <p>** titr.</p>                        | <p><i>U, Ipol: 1...2000 mV<br/>         I, Upol: 0.1...200.0 µA)</i></p>                                                                                                                                                                                                  |               |      |      |           |       |           |       |           |       |            |
| <p><b>dynamics 100 mV</b></p>          | <p>Outside: constant dosing, see page 38.</p>                                                                                                                                                                                                                             |               |      |      |           |       |           |       |           |       |            |
| <p>** titr.</p>                        |                                                                                                                                                                                                                                                                           |               |      |      |           |       |           |       |           |       |            |
| <p>or</p>                              |                                                                                                                                                                                                                                                                           |               |      |      |           |       |           |       |           |       |            |
| <p><b>dynamics 10 µA</b></p>           |                                                                                                                                                                                                                                                                           |               |      |      |           |       |           |       |           |       |            |
| <p><b>max.rate 10 ml/min</b></p>       | <p><i>Maximum dosing rate (0.01...150 mL/min, max.)</i><br/>         &lt;clear&gt; sets "max."<br/>         This parameter determines primarily the addition rate outside the control range, see page 39.<br/>         The maximum rate depends on the Exchange Unit:</p> |               |      |      |           |       |           |       |           |       |            |
| <p>** titr.</p>                        | <table border="0"> <tr> <td>Exchange Unit</td> <td>max.</td> </tr> <tr> <td>5 mL</td> <td>15 mL/min</td> </tr> <tr> <td>10 mL</td> <td>30 mL/min</td> </tr> <tr> <td>20 mL</td> <td>60 mL/min</td> </tr> <tr> <td>50 mL</td> <td>150 mL/min</td> </tr> </table>           | Exchange Unit | max. | 5 mL | 15 mL/min | 10 mL | 30 mL/min | 20 mL | 60 mL/min | 50 mL | 150 mL/min |
| Exchange Unit                          | max.                                                                                                                                                                                                                                                                      |               |      |      |           |       |           |       |           |       |            |
| 5 mL                                   | 15 mL/min                                                                                                                                                                                                                                                                 |               |      |      |           |       |           |       |           |       |            |
| 10 mL                                  | 30 mL/min                                                                                                                                                                                                                                                                 |               |      |      |           |       |           |       |           |       |            |
| 20 mL                                  | 60 mL/min                                                                                                                                                                                                                                                                 |               |      |      |           |       |           |       |           |       |            |
| 50 mL                                  | 150 mL/min                                                                                                                                                                                                                                                                |               |      |      |           |       |           |       |           |       |            |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> <b>min.volume incr. min. µl</b> </div> <p>** titr.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                | <p><i>Minimum volume increment (0.1...9.9 µl)</i><br/>                 This parameter determines the addition rate at the start and the end of the titration, see also page 38.<br/>                 This parameter influences the titration speed and therefore its accuracy very strongly: A smaller "min.volume incr." results in a slower titration.</p>                                                                                                                                                                                                                                                                                                                                                         |
| <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> <b>stop crit: drift</b> </div> <p>** titr.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> <b>stop drift 20 µl/min</b> </div> <p>** titr.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> <b>t(delay) 10 s</b> </div> <p>** titr.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> <b>stop time OFF s</b> </div> <p>** titr.</p> | <p><i>Type of stop criteria (drift, time)</i></p> <p><i>Titration stops if stop drift is reached (1...999 µL/min)</i></p> <p><i>Titration stops if there is no dosing during t(delay) (0...999 s, INF)</i><br/>                 &lt;clear&gt; sets "INF"</p> <p>Switch off when EP is reached and the set time after the last dosing has elapsed.<br/>                 If "INF" = an inquiry for the stop time appears.</p> <p><i>If t(delay) is "INF"</i><br/> <i>Stop after a time (0...999 999 s, OFF)</i><br/>                 &lt;clear&gt; sets "OFF".<br/>                 Stop after expiry of the set time after start of titration. "OFF" means no stop, i.e. titration for an "infinitely" long time.</p> |
| <div style="border: 1px solid black; padding: 5px; width: fit-content; background-color: #cccccc;"> <b>&gt;stop conditions</b> </div>                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p><b>Stop conditions for titration</b><br/>                 If this is not "normal", i.e. after reaching the EP</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> <b>stop V: abs.</b> </div> <p>** titr.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> <b>stop V 99.99 ml</b> </div> <p>** titr.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;"> <b>factor 999 999</b> </div> <p>** titr.</p>                                                                                                                                                     | <p><i>Type of stop volume (abs., rel., OFF)</i><br/>                 "abs.": absolute stop volume in mL.<br/>                 "rel.": relative stop volume to sample size.<br/>                 "OFF": stop volume switched off. Stop volume is not monitored.</p> <p>The stop volume applies for one single titration. The conditioning volume is not monitored.<br/>                 If "abs." is set:</p> <p><i>Absolute stop volume (0...9999.99 mL)</i></p> <p>If "rel." is set:<br/> <i>Factor for relative stop volume (0... ± 999 999)</i><br/>                 Calculated as:<br/>                 Stop V in mL = factor * sample size</p>                                                                  |

**filling rate max. ml/min**

\*\*titr.

*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 |

**>statistics**

**Statistics calculation**

Mean value, absolute and relative standard deviation, see also page 76.

**status: OFF**

\*cond.

*Status of statistics calculation (OFF, ON)*

If statistics calculation is switched off, the following inquiries regarding the statistics do not appear.

**mean n= 2**

\*cond.

*Number n of single values for statistics calculation (2...20)*

**res.tab: original**

\*cond.

*Result table (original, delete n, delete all)*

"original": The original table is used.

Deleted results are again incorporated in the evaluation.

"delete n": Delete of single results with the index n.

"delete all": The entire table is deleted.

**delete n= 1**

\*cond.

*Delete data from sample number n (1...20)*

The deleted result is incorporated in the statistics calculation.

| >preselections                                                                                                             | Preselections for the sequence                                                                                                                                                                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>conditioning:</b>      OFF         </div>   | <p><i>Automatic conditioning of titration vessel (ON, OFF)</i></p> <p>If conditioning is "on", during the titrations the titration solution is constantly maintained at the end point.</p> <p>When conditioning is performed, the volume drift can be displayed during the conditioning:</p> |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>display drift:</b>      ON         </div>   | <p><i>Display of drift during conditioning (ON, OFF).</i></p> <p>Volume drift.</p>                                                                                                                                                                                                           |
| *cond.                                                                                                                     |                                                                                                                                                                                                                                                                                              |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>drift corr:</b>      OFF         </div>     | <p><i>Type of drift correction (auto, man., OFF)</i></p> <p>Type of drift correction: (EP – drift * time)</p> <p>    auto: drift value at start is valid</p> <p>    man.: see below</p> <p>    OFF : no correction</p>                                                                       |
| *cond.                                                                                                                     |                                                                                                                                                                                                                                                                                              |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>drift value 0.0 µl/min</b> </div>           | <p>If "man." is set:</p> <p><i>Value for manual drift correction (0.0...99.9 µl/min)</i></p>                                                                                                                                                                                                 |
| *cond.                                                                                                                     |                                                                                                                                                                                                                                                                                              |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>req. ident:</b>      OFF         </div>     | <p><i>Request of identifications after start of titration (id1, id1 &amp; id2, all, OFF)</i></p> <p>After start, sample identifications can be requested automatically: Only id1, id1 &amp; id2, all three id's or no inquiries.</p>                                                         |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>req. smp1 size:</b>      OFF         </div> | <p><i>Request of sample size after start of titration (value, unit, all, OFF)</i></p> <p>"all" the value and the unit will be requested.</p>                                                                                                                                                 |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>activate pulse:</b>      OFF         </div> | <p><i>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 194f.</i></p>                                                                                                                                                  |

## Titration sequence of KFT

The titration sequence may be configured to match your particular application. The following parameters determine the titration sequence (see diagram below):

- Start delay
- Conditioning (ON, OFF)
- Request of sample identifications and sample size after start of titration
- Pause 1
- Start volume
- Pause 2
- Extraction time

< START >

After start, the activate pulse is transmitted (possibilities to activate pulse, see page 197) and the start delay time is processed.

(Output activate pulse)

If *conditioning* is switched on (which is recommended), the titrant is dosed to the sample solution to reach the end point. When conditioning is completed, the display shows, e.g.

(Start delay)

/KFT conditioning/

or

/drift ok 2.3 µl/min/

(Preconditioning)  
( < START > )  
(Output activate pulse)  
(Start delay)

if the drift display is switched on. Here the current volume drift is displayed continuously during conditioning.

(Request of ident)

The instrument is now ready for titration. Press < START > .

(Request of smpl size)

After start of titration, the activate pulse is transmitted and the start delay time is processed.

(Pause 1)

The temperature is measured (if a T sensor is connected), and depending on the preselections "identifications" and "sample size" arerequested.

(Start volume)

If these requests are switched off, "add sample" is displayed and the titration sequence is stopped for 6 seconds (the sequence can be interrupted by < hold > ). During this pause the sample may be added. Otherwise the sample addition can be done during sample ID or sample size request.

(Pause 2)

After the count down of pause 1, the start volume is dosed.

(Extraction time)  
  
Titration  
observing  
stop conditions

During dosing of the start volume, no control is exerted.

Pause 2 will be attended and the titration is performed to the end point.

The titration will not be terminated before the extraction time has reached.

Data output

At the end of titration, the data are displayed and, if a printer is connected, a specified report is printed out (see also page 78).

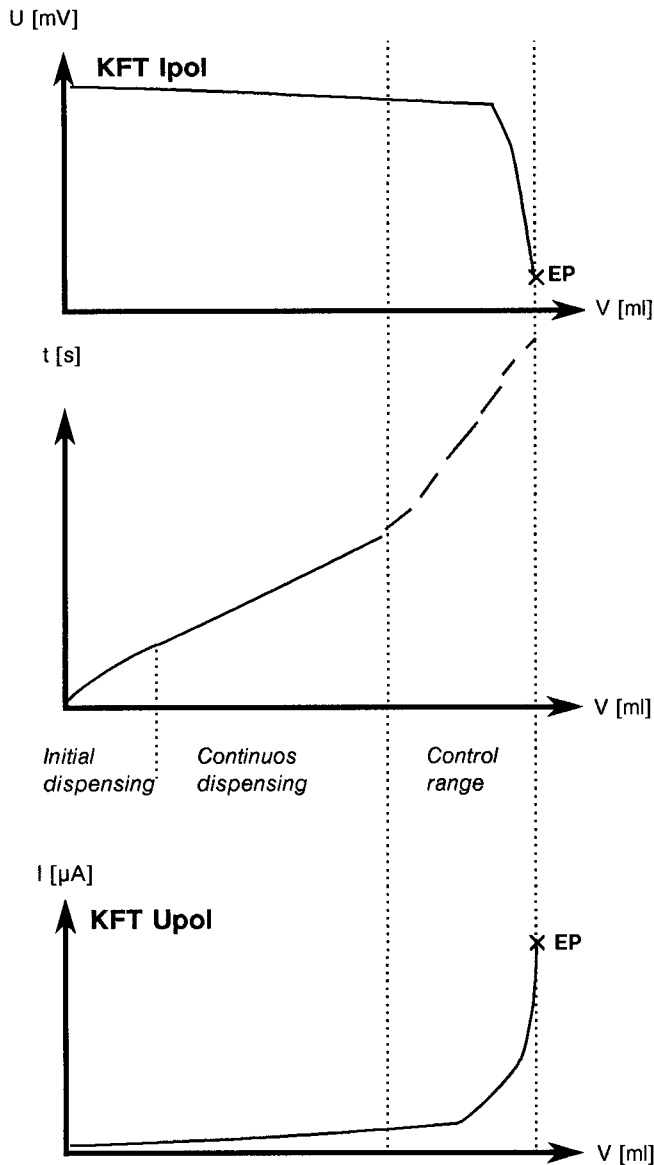
(Reconditioning)

After titration EP1 will again be conditioned (if conditioning is switched on). If after reconditioning 10 % of the cylinder volume is being expelled, it will be refilled.

## Control parameters for KFT

The control parameters can be set separately for each end point. 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:  
During this phase, the dosing rate increases constantly. It starts at the set "min.volume incr." and continues up to the allowed "max.rate".
- 2) Continuous dosing:  
Dosing is performed at the maximum rate "max.rate" until the control range (dynamics) is reached.
- 3) Dynamics (control range)  
In this range, dosing is performed in single steps. The last dosing steps are controlled by the "min.volume incr." parameter.

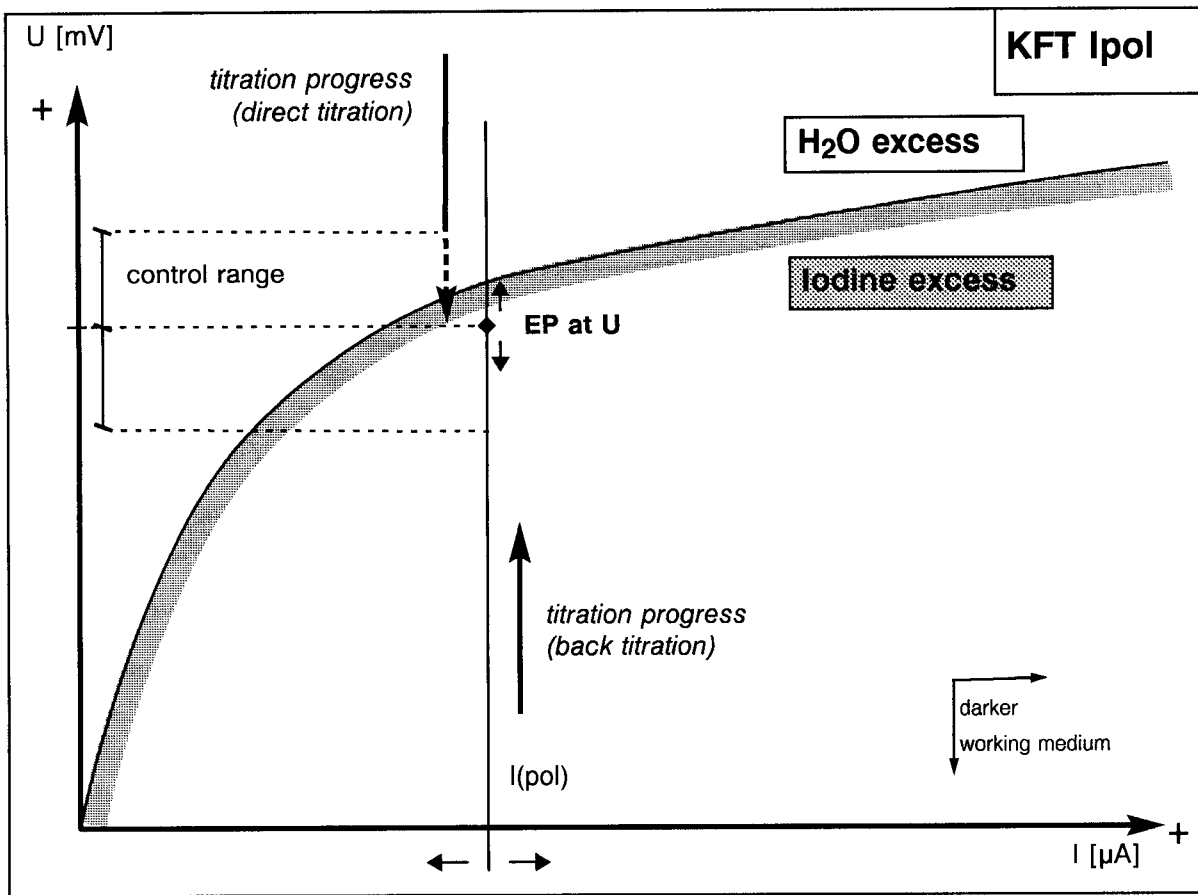
— Ipol results in steeper curves, Upol in rather flat curves.

— In standard-KF titrations the Ipol-mode (featuring default parameters) is to be preferred.

Titer determination should have the same modes for the sample titrations and the parameters.

The particular parameters work in the same manner as in SET.

Mechanisms of the KFT parameters in Ipol mode

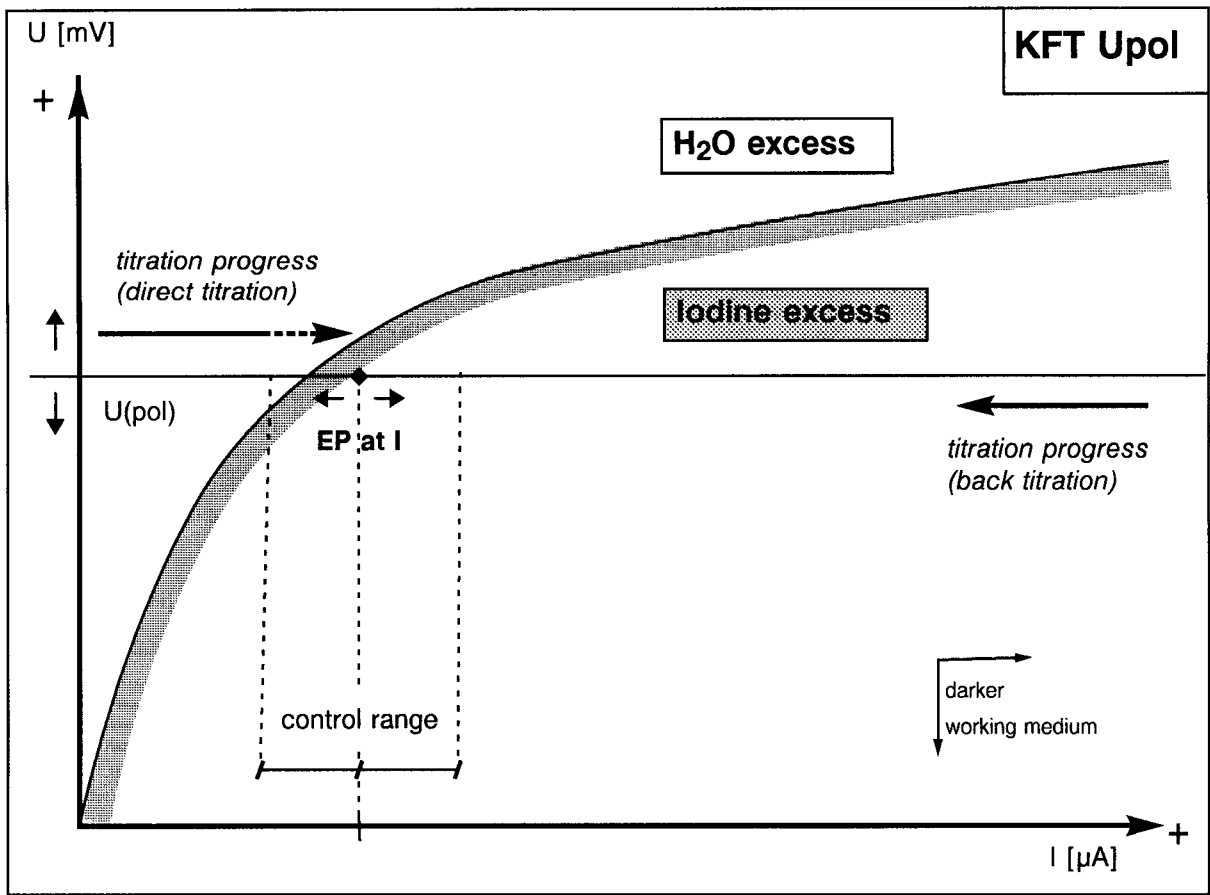


- The position and curve characteristics of the line between the ranges of excess water or excess iodine depends on the type of sample and the ingredients of the working media.
- The end point has to be set close to the range margin, but always within the iodine excess range. If the end point is set too close to the limit, an overdose of KF reagent may be dispensed. The steeper the curve at the preset polarization current  $I(\text{pol})$ , the more delicate it is to titrate to a steady and reproducible end point. For the titration of troublesome samples, the particular conditions must be optimized by trial and error. Always mind the colour of the working medium at the end point as your guideline.

**Remark:** In most cases the preset default parameters of the methods KFT Ipol and KFT Upol provide precise and reproducible results.

- To prevent unreasonable combinations of parameters, do not set any single item to a negative value.

### Mechanisms of the KFT parameters in Upol mode



- In KFT Upol mode, all parameters work in a similar manner as in KFT lpol 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!"   | <ul style="list-style-type: none"> <li>- Increase "min.volume incr."</li> <li>- Change stop criterion. Try to increase stop drift or use a short stopping time as stop criterion, e.g.</li> <li>- With problematical samples change solvents with ketones or aldehydes in 2-methoxyethanol or with amines mixture in methanol/glacial acetic, e.g., see literature..</li> </ul> |
| The increments at the end of the titration are too large. "Overshoots". | <ul style="list-style-type: none"> <li>- Lower "max.rate". The following experiment gives you a reference point for the optimum max.rate:<br/>Drift display during conditioning and add sample without starting the titration. Select a value below the maximum drift as "max.rate".</li> <li>- Optimize setup of electrode and buret tip and improve stirring.</li> </ul>      |
| Solution becomes too brown at the end of the titration.                 | <ul style="list-style-type: none"> <li>- The methanol fraction in the solvent is too low. Change the solvent.</li> <li>- Electrode could be coated; wipe off with acetone.</li> </ul>                                                                                                                                                                                           |
| Solution becomes darker with every titration.                           | <ul style="list-style-type: none"> <li>- Renew solvent.</li> <li>- Electrode could be coated; wipe off with acetone.</li> </ul>                                                                                                                                                                                                                                                 |
| The drift increases with every titration.                               | <ul style="list-style-type: none"> <li>- Does your sample evolve water extremely sluggishly? Work with the KF oven.</li> <li>- Are acids esterified in your sample? Change solution more frequently. Increase buffer capacity of the solvent.</li> <li>- Does your sample contain ketones or aldehydes? Use special reagents suitable for ketones and aldehydes.</li> </ul>     |
| The endpoint is reached "too rapidly".                                  | <ul style="list-style-type: none"> <li>- Reduce max.rate.</li> </ul>                                                                                                                                                                                                                                                                                                            |
| The titration times become longer and longer.                           | <ul style="list-style-type: none"> <li>- With 2-component reagents the buffer capacity of the solvent can be exhausted. Change solution.</li> <li>- If the drift increases at the same time, see above.</li> </ul>                                                                                                                                                              |

## 2.6.4 Parameters for STAT

| <b>&gt;control parameters</b>                                                                                                                              | <b>Control parameters</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |      |      |           |       |           |       |           |       |            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------|------|-----------|-------|-----------|-------|-----------|-------|------------|
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>EP at pH</b>                      <b>OFF</b> </div> <p>** titr.</p>         | <p><i>Endpoint, control point: This value is kept constant. (input range depends on the measured quantity:</i><br/> <i>pH:            0... ± 20.00, OFF</i><br/> <i>U, Ipol:      0... ± 2000 mV, OFF</i><br/> <i>Upol:        0... ± 200.0 uA, OFF)</i><br/>                     &lt;clear&gt; sets "OFF".</p>                                                                                                                                                                                                                                                                                                                                                        |               |      |      |           |       |           |       |           |       |            |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>dynamics</b>                      <b>1</b> </div> <p>** titr.</p>           | <p><i>Controlling range (input range depends on the measured quantity:</i><br/> <i>pH:            0.01...20.00, OFF</i><br/> <i>U, Ipol:      1...2000 mV, OFF</i><br/> <i>Upol:        0.1...200.0 uA, OFF)</i><br/>                     &lt;clear&gt; sets "OFF".<br/>                     "OFF" means largest control range, i.e. always controlled reagent addition.<br/>                     Outside: constant dosing, see also page 50.</p>                                                                                                                                                                                                                      |               |      |      |           |       |           |       |           |       |            |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>max.rate</b>                      <b>10 ml/min</b> </div> <p>** titr.</p>   | <p><i>Maximum dosing rate (0.01...150 mL/min, max.)</i><br/>                     &lt;clear&gt; sets "max.". This parameter determines primarily the addition rate outside the control range, see page 50.<br/>                     The maximum rate depends on the Exchange Unit:</p> <table border="0" style="margin-left: 20px;"> <thead> <tr> <th style="text-align: left;">Exchange Unit</th> <th style="text-align: left;">max.</th> </tr> </thead> <tbody> <tr> <td>5 mL</td> <td>15 mL/min</td> </tr> <tr> <td>10 mL</td> <td>30 mL/min</td> </tr> <tr> <td>20 mL</td> <td>60 mL/min</td> </tr> <tr> <td>50 mL</td> <td>150 mL/min</td> </tr> </tbody> </table> | Exchange Unit | max. | 5 mL | 15 mL/min | 10 mL | 30 mL/min | 20 mL | 60 mL/min | 50 mL | 150 mL/min |
| Exchange Unit                                                                                                                                              | max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |      |      |           |       |           |       |           |       |            |
| 5 mL                                                                                                                                                       | 15 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |      |      |           |       |           |       |           |       |            |
| 10 mL                                                                                                                                                      | 30 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |      |      |           |       |           |       |           |       |            |
| 20 mL                                                                                                                                                      | 60 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |      |      |           |       |           |       |           |       |            |
| 50 mL                                                                                                                                                      | 150 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |      |      |           |       |           |       |           |       |            |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>min.rate</b>                      <b>25.0 uL/min</b> </div> <p>** titr.</p> | <p><i>Minimum dosing rate (0.01...999.9 uL/min)</i><br/>                     This parameter determines the addition rate in the range of the control point.<br/>                     Rule of thumb for "min.rate" in uL/min = (expected rate of the reaction in uL/min)/10.</p>                                                                                                                                                                                                                                                                                                                                                                                        |               |      |      |           |       |           |       |           |       |            |

| >titration parameters                                                                                                                               | Titration parameters                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |      |      |           |       |           |       |           |       |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------|------|-----------|-------|-----------|-------|-----------|-------|------------|
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>start V:</b>                    <b>OFF</b> </div>                    | <p>Type of start volume (OFF, abs., rel.)<br/>                     "OFF": start volume switched off<br/>                     "abs.": absolute start volume in mL<br/>                     "rel.": relative start volume to sample size.</p>                                                                                                                                                                                                                                                                       |               |      |      |           |       |           |       |           |       |            |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>start V</b>                    <b>0.00 ml</b> </div>                 | <p>If "abs." is set:<br/>                     Absolute start volume (0...999.99 mL)</p>                                                                                                                                                                                                                                                                                                                                                                                                                           |               |      |      |           |       |           |       |           |       |            |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>factor</b>                    <b>0</b> </div>                        | <p>If "rel." is set:<br/>                     Factor for relative start volume (0... ± 999 999).<br/>                     Calculated as:<br/>                     start V in mL = factor * sample size</p>                                                                                                                                                                                                                                                                                                        |               |      |      |           |       |           |       |           |       |            |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>dos.rate</b>                <b>max. ml/min</b> </div> <p>**titr.</p> | <p>Dosing rate for start volume<br/>                     (0.01...150 mL/min, max.)<br/>                     &lt;clear&gt; sets "max.". The maximum rate depends on the Exchange Unit:</p> <table border="0" style="margin-left: 20px;"> <tr> <td style="padding-right: 20px;">Exchange Unit</td> <td>max.</td> </tr> <tr> <td>5 mL</td> <td>15 mL/min</td> </tr> <tr> <td>10 mL</td> <td>30 mL/min</td> </tr> <tr> <td>20 mL</td> <td>60 mL/min</td> </tr> <tr> <td>50 mL</td> <td>150 mL/min</td> </tr> </table> | Exchange Unit | max. | 5 mL | 15 mL/min | 10 mL | 30 mL/min | 20 mL | 60 mL/min | 50 mL | 150 mL/min |
| Exchange Unit                                                                                                                                       | max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |      |      |           |       |           |       |           |       |            |
| 5 mL                                                                                                                                                | 15 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |               |      |      |           |       |           |       |           |       |            |
| 10 mL                                                                                                                                               | 30 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |               |      |      |           |       |           |       |           |       |            |
| 20 mL                                                                                                                                               | 60 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |               |      |      |           |       |           |       |           |       |            |
| 50 mL                                                                                                                                               | 150 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |      |      |           |       |           |       |           |       |            |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>pause</b>                    <b>0 s</b> </div> <p>** titr.</p>       | <p>Waiting time after start volume (0...999 999 s)<br/>                     Waiting time, e.g. for equilibration of the electrode after start or reaction time after dosing of a start volume. The equilibration time can be aborted with &lt;QUIT&gt; .</p>                                                                                                                                                                                                                                                      |               |      |      |           |       |           |       |           |       |            |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>start time</b>                <b>0 s</b> </div>                      | <p>Start time for data acquisition (0...999 999 s)<br/>                     Measured values will be acquired only after the start time has elapsed.</p>                                                                                                                                                                                                                                                                                                                                                           |               |      |      |           |       |           |       |           |       |            |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>start pH</b>                    <b>OFF</b> </div>                    | <p>Start measured value for data acquisition (input range depends on the measured quantity:<br/>                     pH:            0... ± 20.00, OFF<br/>                     U, Ipol:      0... ± 2000 mV, OFF<br/>                     Upol:        0... ± 200.0 uA, OFF)<br/>                     &lt;clear&gt; sets "OFF".<br/>                     Measured values will be acquired only after start of measured value has been reached.</p>                                                                |               |      |      |           |       |           |       |           |       |            |

|                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>start rate</b>      <b>OFF</b></p>                                                                                                                                                                                                                                               | <p><i>Start rate for data acquisition (0.01...150 mL/min, OFF)</i><br/>         &lt;clear&gt; sets "OFF".<br/>         Measured values will be acquired only if the current rate is below the start rate. This criterion effective 10 s after the start.</p>                                                                                                                                                                                                                                                                                                                                                                                 |
| <p><b>time interval</b>      <b>2 s</b></p>                                                                                                                                                                                                                                            | <p><i>Time interval for data acquisition (1..999 999 s)</i><br/>         Time interval for the entry of the values in the measuring point list. The measuring point list can contain max. 500 points.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <p><b>titr.direction:</b>      <b>auto</b></p>                                                                                                                                                                                                                                         | <p><i>Direction is set automatically (+, -, auto)</i><br/>         auto: The direction is set automatically by the Titrino (sign [U<sub>init</sub> - EP]).<br/>         +: Direction of higher pH, higher voltage (more "positive"), larger currents.<br/>         -: Direction of lower pH, lower voltage, smaller currents.</p>                                                                                                                                                                                                                                                                                                            |
| <p><b>dos.element:</b> <b>internal D0</b></p>                                                                                                                                                                                                                                          | <p><i>Selection of dosing element (internal D0, external D1, external D2)</i><br/>         internal D0: internal buret of the Titrino<br/>         external D1/2: buret D1, D2, resp.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <p><b>meas. input:</b>      <b>1</b></p> <p style="text-align: center;">or</p> <p><b>I(pol)</b>      <b>1 uA</b></p> <p style="text-align: center;">or</p> <p><b>U(pol)</b>      <b>400 mV</b></p> <p style="text-align: center;">or</p> <p><b>electrode test:</b>      <b>OFF</b></p> | <p><i>Measuring input for pH and U. (1, 2, diff.)</i><br/>         Request only with measured quantities pH and U.<br/>         Measuring input 1 or 2 or differential amplifier; connection of electrodes, see page 187.</p> <p>With polarized electrodes, instead of the measuring input the <i>polarization current (-127...127 uA)</i> or the <i>polarization potential (-1270...1270 mV, in steps of 10 mV)</i> is inquired.<br/> <i>Electrode test (OFF, ON)</i><br/>         Test for polarized electrodes. Performed on changeover from the inactive standby state to a measurement. "OFF" means that the test is not performed.</p> |
| <p><b>temperature</b>      <b>25.0 °C</b></p>                                                                                                                                                                                                                                          | <p><i>Temperature (-170.0...500.0 °C)</i><br/>         If a T sensor is attached, the temperature is measured continuously and the pH values corrected accordingly.<br/>         The last measured value is entered as the "temperature" parameter.</p>                                                                                                                                                                                                                                                                                                                                                                                      |

**>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 51.

If "abs.", "delta" or "delay" are set:

Request of time (0...999 999 s)

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 |

|                       |                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>&gt;statistics</b> | <b>Statistics calculation</b><br>Mean value, absolute and relative standard deviation, see also page 76.                                                                                                                                                                                                                                                                    |
| status: OFF           | <i>Status of statistics calculation (OFF, ON)</i><br>If the statistics calculation is switched off, the following inquiries regarding the statistics do not appear.                                                                                                                                                                                                         |
| mean n= 2             | <i>Mean value calculation from n single results (2...20)</i>                                                                                                                                                                                                                                                                                                                |
| res.tab: original     | <i>Result table (original, delete n, delete all)</i><br>"original": The original table is used. Deleted individual results are again incorporated in the evaluation.<br>"delete n": Deletion of single results with the index n.<br>"delete all": The entire table is deleted.                                                                                              |
| delete n= 1           | <i>Delete data from sample number n (1...20)</i><br>The deleted result is removed from the statistics calculation.                                                                                                                                                                                                                                                          |
| <b>&gt;evaluation</b> | <b>Evaluation</b><br>see also page 53.                                                                                                                                                                                                                                                                                                                                      |
| low lim. OFF s        | <i>Evaluation of dosing rates within time windows (0...999 999 s, OFF)</i><br>Up to 9 time windows in which a rate should be calculated. The rates are available for calculations as C8X.<br>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. |
| up lim. OFF s         |                                                                                                                                                                                                                                                                                                                                                                             |
| fix V1 OFF s          | <i>Interpolation of the volume at a fixed time (0...999 999 s, OFF)</i><br>Up to 9 fix V. The associated volumes are available for calculations as C5X.                                                                                                                                                                                                                     |
| fix time 1 OFF V(tot) | <i>Interpolation of times at volume ratios at the end V (0.01 ... 1.00, OFF)</i><br>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 measured values**

Out of limits are marked in the measuring point list.

**meas.val: OFF**

*Monitoring of measured values (ON, OFF)*

With "on" follow the requests:

\*\*titr.

**low lim.pH -20.00**

*Limits for measured values (input range depends on the measured quantity):*

*pH: 0... ± 20.00*

*U, Ipol: 0... ± 2000 mV*

*Upol: 0... ± 200.0 uA)*

\*\*titr.

**up lim.pH 20.00**

\*\*titr.

**action: none**

*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.*

\*\*titr.

**rate: OFF**

*Monitoring of rate (ON, OFF)*

With "on" follow the requests:

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

\*\*titr.

**low lim. 0.000 mL/min**

*Action if a limit is exceeded (end, hold, wait, none)*

*end: Abort.*

*hold: Hold reagent addition until manually restarted.*

\*\*titr.

**up lim. 150 mL/min**

\*\*titr.

**action: none**

*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!*

\*\*titr.

**temperature: OFF**

*Monitoring of temperature (ON, OFF)*

With "on", the following requests:

\*\*titr.

**low lim. -170.0 °C**

*Limit values (-170.0...500.0 °C)*

*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.*

\*\*titr.

**up lim. 500.0 °C**

\*\*titr.

**action: none**

\*\*titr.

|                                   |                                                                                                                                                                                                                            |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>assign output:</b> <b>none</b> | <i>Assignment of output L4 for monitoring (meas, temp, rate, all, none)</i><br>A signal can be output at L4 (pin 3) of the remote socket if a limit value has been exceeded.                                               |
| **titr.                           |                                                                                                                                                                                                                            |
| <b>L4 output:</b> <b>pulse</b>    | <i>Set a signal when values are out of limit. (active, pulse) of the remote socket:</i><br>active: Output line is set to 0 V.<br>pulse: Pulse > 100 ms.<br>Important: An active line will be set inactive with an impulse! |
| **titr.                           |                                                                                                                                                                                                                            |
| <b>&gt;preselections</b>          | <b>Preselections for the sequence</b>                                                                                                                                                                                      |
| <b>req. ident:</b> <b>OFF</b>     | <i>Request of sample identifications after start of titration (id1, id 1 &amp;id2, all, OFF)</i><br>After start, sample identifications can be inquired automatically: Only id1, id1 &id2, all three id's or no inquiries. |
| <b>req. smp1 size:</b> <b>OFF</b> | <i>Request of sample size after start of titration (value, unit, all, OFF)</i>                                                                                                                                             |
| <b>display rate:</b> <b>OFF</b>   | <i>Display rate (ON, OFF)</i><br>Instead of the temperature the rate is displayed.                                                                                                                                         |
| <b>activate pulse:</b> <b>OFF</b> | <i>Pulse output on line "activate" (L6, pin1) of the remote socket (ON, OFF), see page 194.</i>                                                                                                                            |

## Sequence with STAT

The start of the sequence depends on the application and can be configured with the following parameters (see schematic representation below):

- Start delay (setting under <configuration>, >auxiliaries).
- Request of sample identifications and sample size following titration start

< START >

(output activate pulse)

(start delay)

(request ident.)

(request sample size)

(start V, pause)

(start time)

(start pH)

(start rate)

Control  
Measuring point list  
(Monitoring)

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

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

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

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

The limit values are checked when the monitoring is switched on.

Once the start conditions have been met, measured points (time, volume) are entered in the measuring point list. If the monitoring of the measured value and/or the temperature is active, these values are also entered in the measuring point list. Violations of the limit values are marked in the measuring point list.

The temperature is measured continuously, i.e. a T measurement is carried out every 2 s; the slope of pH electrodes is corrected. If no T sensor is connected, only measured values are recorded (without interruption by the temperature measurement) and the temperature set manually applies.

Stop when stop criterion  
attained

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

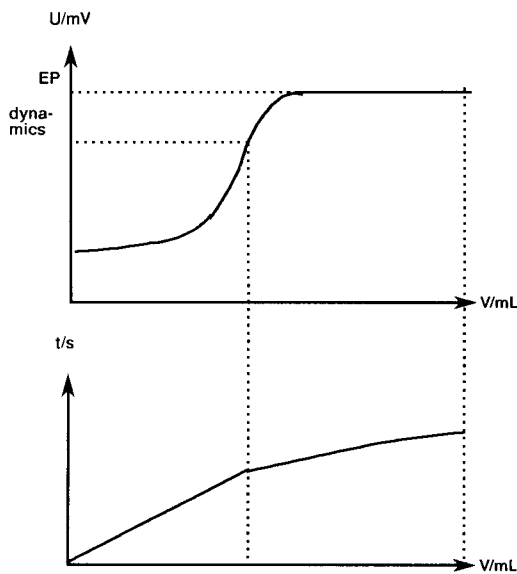
Evaluation

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

Data output

Finally, the data are put out. If a printer is connected, see page 78.

## Control parameters



Dosing outside the control range (dynamics):  
Here, the principal determining factor for the addition rate is the "max.rate".

Optimise "max.rate" and "dynamics" together so that overshooting of the titration is kept to a minimum on run-up.

Select dynamics (control range) such that the measured value is within the control range when held. With slow reactions, set dynamics rather large, e.g.  $\Delta\text{pH} = 3$  or  $\Delta U = 180 \text{ mV}$ . In many cases, the control point is reached with a SET pretitration so that dynamics are not a critical parameter.

Dosing within the control range:

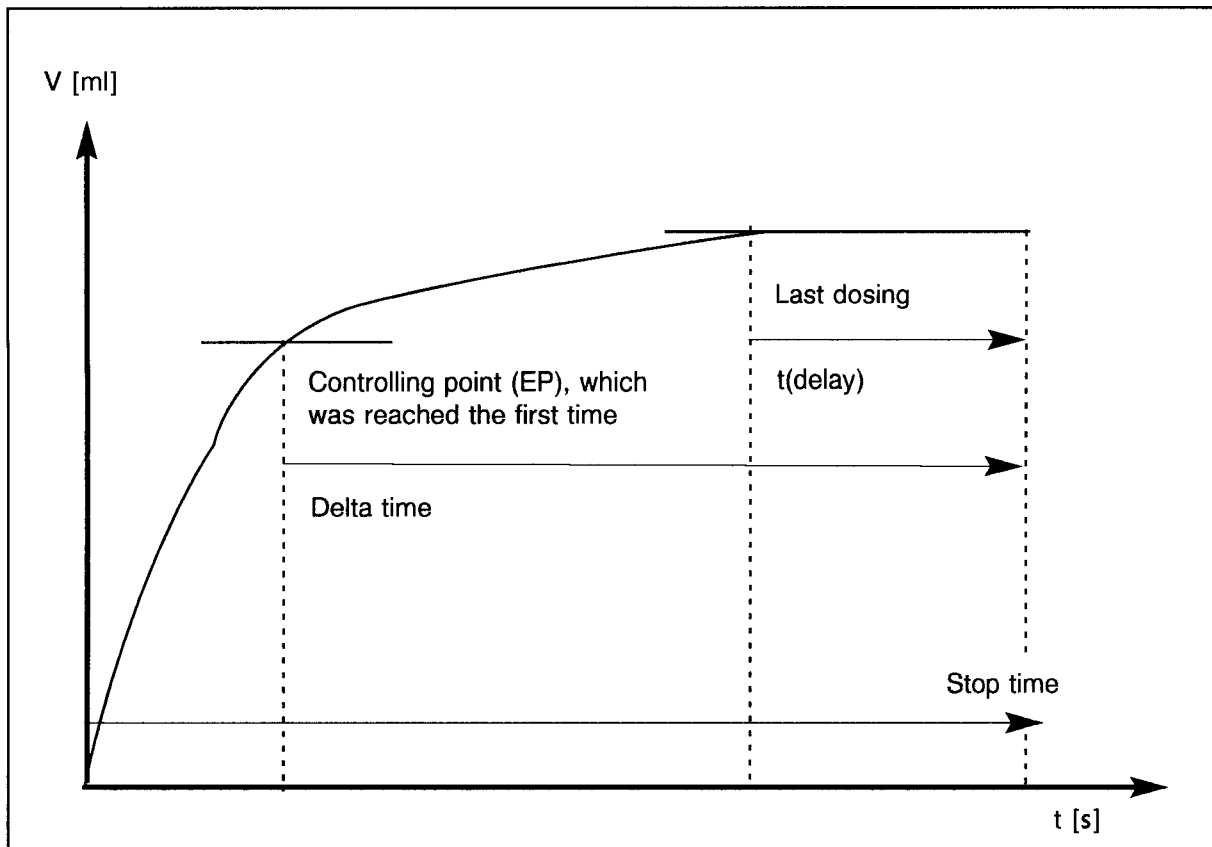
Here, the principal determining factor for the addition rate is "min.rate".

Rule of thumb for "min.rate": "min.rate" in  $\mu\text{L}/\text{min} = (\text{Expected rate of the reaction in } \mu\text{L}/\text{min})/10$ .

### 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". | <ul style="list-style-type: none"> <li>- Set "max.rate" and possibly also "min.rate" lower.</li> <li>- Set "dynamics" larger.</li> <li>- Is the stirring efficiency adequate?</li> <li>- Arrange electrode and buret tip properly, see page 186.</li> <li>- Are the tubing lengths kinked?</li> <li>- Possibly use Exchange Unit with a small cylinder volume (smaller volume increment per pulse).</li> </ul> |
| Time for reaching the control point is too long.                                                                       | <ul style="list-style-type: none"> <li>- Set "dynamics" smaller.</li> <li>- Set "min.rate" higher.</li> <li>- Set "max.rate" higher.</li> </ul>                                                                                                                                                                                                                                                                |

## 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            |            |         |          |       |
| 736 GP Titrino | OP1/101    |         | 736.0010 |       |
| date 96-01-26  | 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 limit value was violated.
- ← Temperature limit value was violated.
- ← pH limit value was violated.
- ← The dispensing was interrupted.

## Evaluation

### Rates C8X

The rates are calculated by linear regression.

C80 is the mean rate over all points of the measuring point list.

C8X ( $9 \leq X < 0$ ) 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                |            |          |            |
| 736 GP Titrino     | OP1/101    | 736.0010 |            |
| date 96-01-26      | time 08:54 | 14       |            |
| pH(init) 7.42      | STAT pH    | *****    |            |
| smp1 size 1.0021 g |            |          |            |
| t/s                | V/ml       | pH       | T/°C mess. |
| 0                  | 0.0000     | 7.434    | 35.5       |
| 30                 | 0.9140     | 3.039    | 35.7       |
| 60                 | 1.0010     | 3.056    | 36.0       |
| 90                 | 1.0780     | 3.022    | 36.2       |
| 120                | 1.1470     | 2.972    | 36.4       |
| 150                | 1.2250     | 3.018    | 36.5       |
| :                  |            |          |            |
| :                  |            |          |            |
| 1560               | 6.3290     | 2.994    | 37.0       |
| 1590               | 6.3290     | 2.998    | 37.0       |
| 1620               | 6.3290     | 2.998    | 37.0       |
| 1650               | 6.3290     | 2.998    | 37.0       |
| 1680               | 6.3465     | 2.975    | 37.0       |
| :                  |            |          |            |

← Specified time window for the rate calculation: 40...100 s.

← Measured points used for the regression: 30...120 s

← Fix time: 0.8 V(tot) → 1650 s

## 2.6.5 Parameters for DOS

| <div style="border: 1px solid black; padding: 2px; background-color: #e0e0e0;">&gt;dosing parameters</div> | Dosing parameters                                                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div style="border: 1px solid black; padding: 2px;">dispensing type: volume</div>                          | <p><i>Type of dosing (volume, time, rate)</i><br/>Main parameters.<br/>Two parameters of the equation "rate = volume/time" are specified, the third is calculated.</p>                                                                                                                                       |
| <div style="border: 1px solid black; padding: 2px;">volume 10.00 ml</div>                                  | <p>The request which appears depends on the type of dosing selected:<br/><i>Volume (0...99 999.99 mL)</i></p>                                                                                                                                                                                                |
| <div style="border: 1px solid black; padding: 2px;">disp.time 100 s</div>                                  | <p><i>Dispensing time (1...999 999 s)</i><br/>Dispensing time only. Waiting times, e.g. for refilling are not included.</p>                                                                                                                                                                                  |
| <div style="border: 1px solid black; padding: 2px;">rate max. ml/min</div>                                 | <p><i>Rate (0.001...150 mL/min, max.)</i></p>                                                                                                                                                                                                                                                                |
| <div style="border: 1px solid black; padding: 2px;">disp.crit: rate</div>                                  | <p><i>Dispensing criterion (volume, time, rate)</i><br/>Selection of the second dispensing parameter. The request which appears depends on the dispensing criterion selected.</p>                                                                                                                            |
| <div style="border: 1px solid black; padding: 2px;">pause 0 s</div> <p>** titr.</p>                        | <p><i>Pause (0...999 999 s)</i><br/>Waiting time, e.g. for stabilisation of the electrode after start. The waiting time can be aborted with &lt;QUIT&gt;.</p>                                                                                                                                                |
| <div style="border: 1px solid black; padding: 2px;">time interval 10 s</div>                               | <p><i>Time interval (1...999 999 s)</i><br/>Time interval for the entry of the values in the measuring point list. The measuring point list can contain max. 500 points.</p>                                                                                                                                 |
| <div style="border: 1px solid black; padding: 2px;">dos.element: internal D0</div>                         | <p><i>Selection of dosing element (internal D0, external D1, external D2)</i><br/>internal D0: internal buret of the Titrimo<br/>external D1/2: buret D1, D2, resp</p>                                                                                                                                       |
| <div style="border: 1px solid black; padding: 2px;">temperature 25.0 °C</div>                              | <p><i>Temperature (-170.0...500.0 °C)</i><br/>If a T sensor is connected, the temperature is measured continuously and the pH values are corrected accordingly.<br/>The last measured value is entered as the "temperature" parameter.<br/>Without a T sensor, the temperature entered manually applies.</p> |

**>stop conditions**

**Stop conditions**

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

stop V: OFF

\*\*titr.

stop V 99.99 ml

\*\*titr.

factor 999999

\*\*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:

Absolute stop volume (0...99 999.99 mL)

If "rel." is set:

Factor for relative stop volume (0... ± 999 999)

Calculated using:

Stop V in mL = factor \* sample size

filling rate max. ml/min

\*\*titr.

Filling rate (0.01...150 mL/min, max.)

< clear > sets "max".

The maximum rate depends on the Exchange Unit:

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

**>statistics**

**Statistics calculation**

Mean value, absolute and relative standard deviation, see also page 76.

status: OFF

Status of statistics calculations (OFF, ON)

If statistics calculation is switched off, the following requests do not appear.

mean n= 2

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

res.tab: original

Result table (original, delete n, delete all)

"original": The original table is used.

Deleted individual results are reincorporated in the evaluation.

"delete n": Deletes individual results with the index n.

"delete all": The entire table is deleted.

delete n= 1

Delete data from sample number n (1...20)

The deleted result is removed from the statistics calculation.

**>monitoring**

**meas.mode:** OFF

**meas.input:** 1

or

**I(pol)** 1 uA

or

**U(pol)** 400 mV

**electrode test:** OFF

**low lim.pH** -20.00

\*\*titr.

**up lim.pH** 20.00

\*\*titr.

**action:** none

\*\*titr.

**Monitoring of measured values**

Limit value violations are marked in the measuring point list.

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

*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 187.

With polarised electrodes, the request of the measuring input is replaced by one regarding the *polarization current (-127...127 uA)*, or the *polarization voltage (-1270...1270 mV, in steps of 10 mV)*

*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.

*Limit values for the measured value (input range depends on the measured quantity:*

*pH: 0... ± 20.00*

*U, Ipol: 0... ± 2000 mV*

*Upol: 0... ± 200.0 uA)*

*Action if 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.

**low lim.** -170.0 °C

\*\*titr.

**up lim.** 500.0 °C

\*\*titr.

**action:** none

\*\*titr.

*Monitoring of temperature (ON, OFF)*

With "on", the following requests:

*Evaluation of dosing rates within time windows (-170.0...500.0 °C)*

*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: none**

\*\*titr.

*Assignment of output I/O lines (meas, temp, all, none)*

L4 output sets a signal when values are out of limit (pin 3).

**L4 output: pulse**

\*\*titr.

*Type of signal at L4 output (active, pulse) of the remote socket:*

active: Output line is set to 0 V.

pulse: Pulse > 100 ms.

Important: An active line will be set inactive with a impulse!

**>preselections**

### Preselections for the sequence

**req.ident: OFF**

*Request of sample identifications after start of titration (id1, id1 & id2, all, OFF)*

After start, sample identifications can be inquired automatically; Only id1, id1 & id2, all three id0s or no inquiries.

**req.smp1 size: OFF**

*Request of sample size after start of titration (value, unit, all, OFF)*

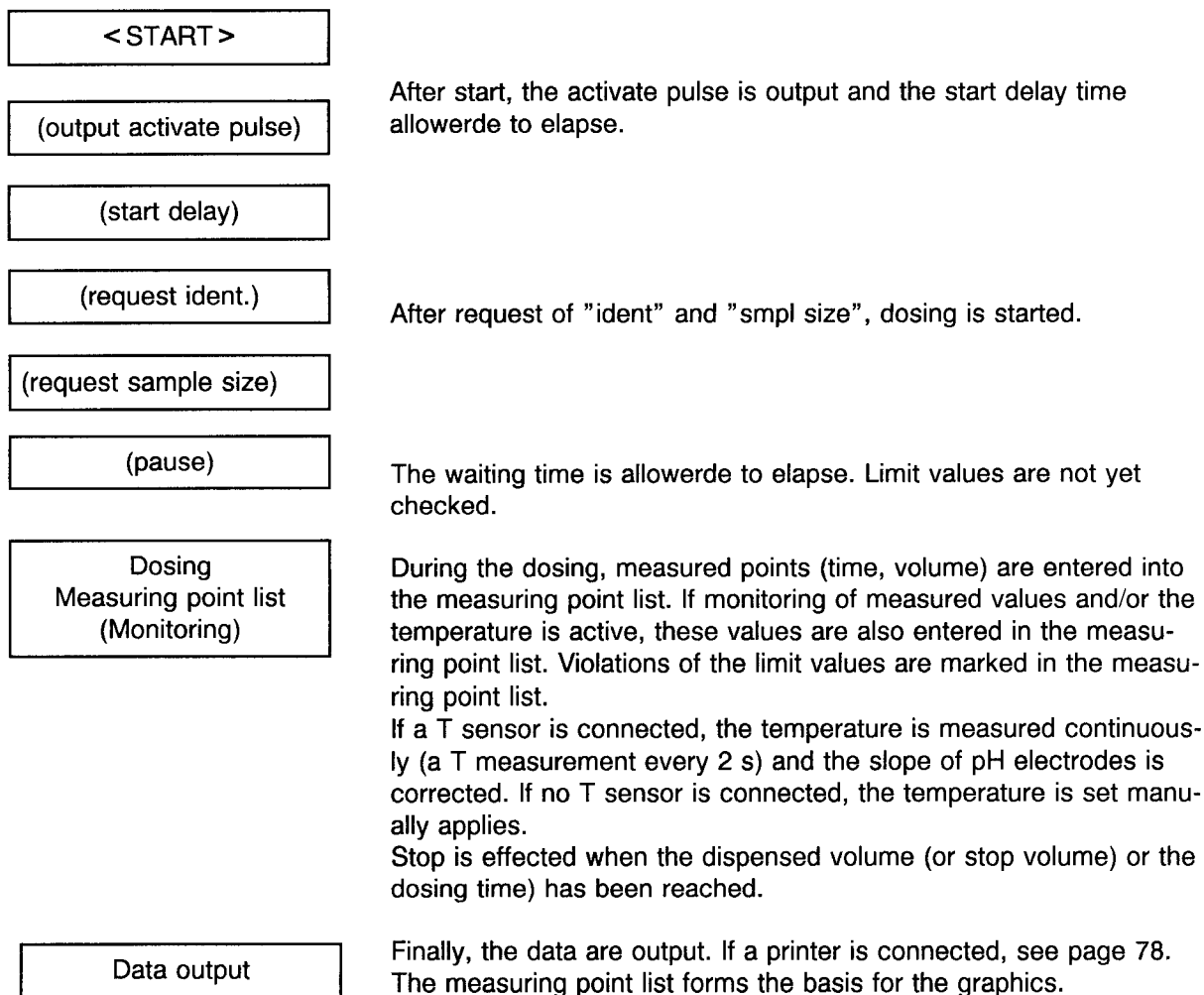
**activate pulse: OFF**

*Pulse output on the line "activate" (L6, pin1) of the remote socket (ON, OFF)  
see page 194.*

## Sequence with DOS

The start of sequence depends on the application and can be configured with the following parameters (see schematic representation below):

- Start delay (setting under <configuration>, > auxiliaries)
- Request of sample identifications and sample size following the start



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

## Filling times

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

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

The max. filling rate depends on the Exchange unit installed, see page 55. 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 = 60 min.

Dispensed volume = 1000 mL

Filling time = 23 s (filling rate = max.)

Volume of the Exchange Unit = V(B) = 50 mL

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

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

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

Summary in a formula:

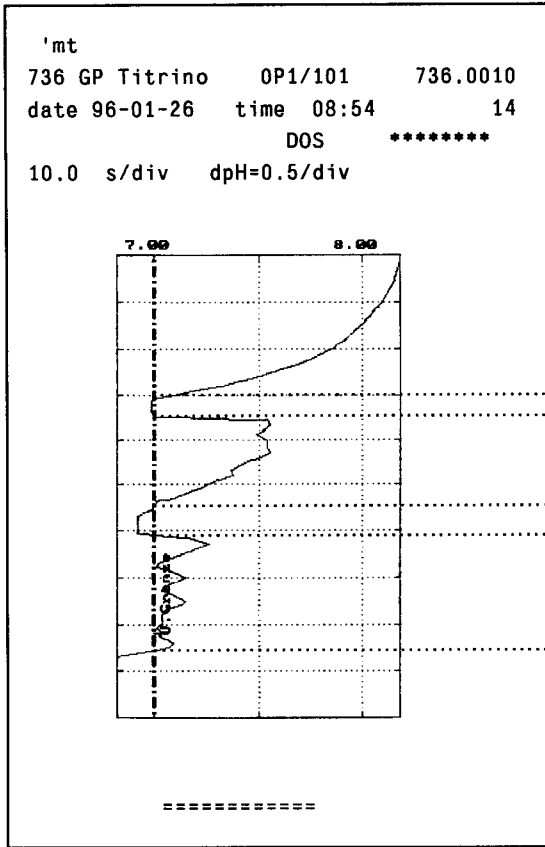
$$\text{Rate} = \frac{\text{Dispensed volume}}{\text{Dispensing time} - \text{refilling} * \text{filling time} * 1/60} = \frac{1000}{60 - 19 * 23 * 1/60} = 18.972 \text{ mL/min}$$

## Measuring point list and monitoring

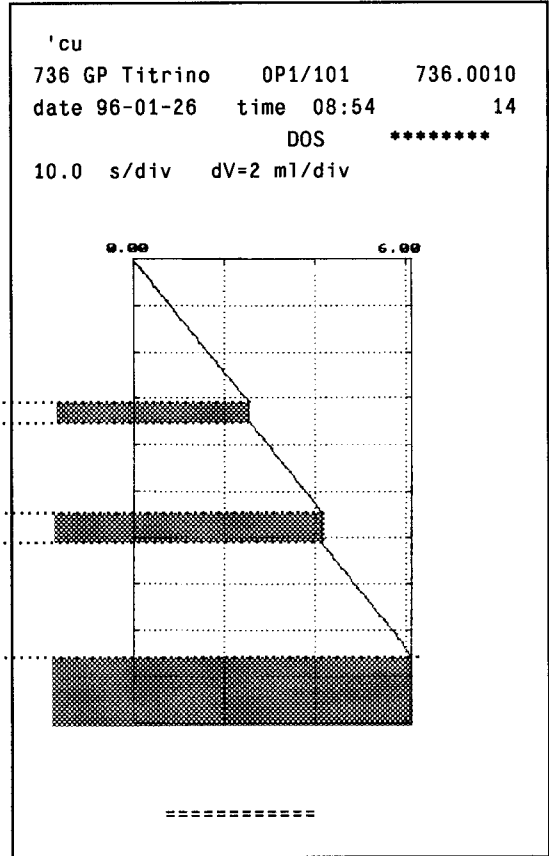
- Measured points are entered in the measuring point list at the preset time interval. The input times represent the clock time. This must be distinguished from the dispensing time: The dispensing time does not include any waiting times which can arise in refilling, hold or wait as a result of limit 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 52. "\*" is also used in this column to mark when the dispensing was interrupted: refilling, action "wait" or "hold" on limit value violation or manual <hold>.
- The volume of the last measured point entry can differ from the final volume as time may have elapsed between the last entry and the actual stop.

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

Curve pH vs Time ("meas crv")



Curve Volume vs Time ("curve")



action:  
wait

## 2.6.6 Parameters for DOC

| >dosing parameters                                                                                                                                                        | Dosing parameters                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |      |      |           |       |           |       |           |       |            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------|------|-----------|-------|-----------|-------|-----------|-------|------------|
| <div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> <span>begin at</span> <span>init</span> </div>                        | <p><i>Start of the measured value for the beginning of dosing (input range depends on the measured quantity):</i><br/>                     pH: 0... ± 20.00, init<br/>                     U, Ipol: 0... ± 2000 mV, init<br/>                     Upol: 0... ± 200.0 uA, init<br/>                     &lt;clear&gt; sets "init" = initial measured value.</p>                                                                                                                                                                                                                                                                     |               |      |      |           |       |           |       |           |       |            |
| <div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> <span>end at</span> <span>OFF</span> </div>                           | <p><i>Final measured value (input range depends on the measured quantity):</i><br/>                     pH: 0... ± 20.00, OFF<br/>                     U, Ipol: 0... ± 2000 mV, OFF<br/>                     Upol: 0... ± 200.0 uA, OFF<br/>                     &lt;clear&gt; sets "OFF"</p>                                                                                                                                                                                                                                                                                                                                      |               |      |      |           |       |           |       |           |       |            |
| <div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> <span>sweep time</span> <span>300 s</span> </div>                     | <p><i>Sweep time for measured value (0...999 999 s)</i><br/>                     The change in the set measured value from the initial to the final value within the sweep time is linear.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |      |      |           |       |           |       |           |       |            |
| <div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> <span>dynamics</span> <span>0.25</span> </div> <p>** titr.</p>        | <p><i>Control range (input range depends on the measured quantity):</i><br/>                     pH: 0...20.00, OFF<br/>                     U, Ipol: 0... ± 2000 mV, OFF<br/>                     Upol: 0... ± 200.0 uA, OFF<br/>                     &lt;clear&gt; sets "OFF".<br/>                     "OFF" means largest control range (dynamics), i.e. slow reagent addition.<br/>                     Outside the control range, dispensing is performed continuously, see also page 67.</p>                                                                                                                                |               |      |      |           |       |           |       |           |       |            |
| <div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> <span>max.rate</span> <span>max. ml/min</span> </div> <p>** titr.</p> | <p><i>Maximum rate (0.01...150 mL/min, max)</i><br/>                     &lt;clear&gt; sets "max."<br/>                     This parameter primarily determines the addition rate outside the control range, see also page 67.<br/>                     The maximum rate depends on the Exchange Unit:</p> <table border="0" style="margin-left: 20px;"> <tr> <td style="padding-right: 20px;">Exchange Unit</td> <td>max.</td> </tr> <tr> <td>5 mL</td> <td>15 mL/min</td> </tr> <tr> <td>10 mL</td> <td>30 mL/min</td> </tr> <tr> <td>20 mL</td> <td>60 mL/min</td> </tr> <tr> <td>50 mL</td> <td>150 mL/min</td> </tr> </table> | Exchange Unit | max. | 5 mL | 15 mL/min | 10 mL | 30 mL/min | 20 mL | 60 mL/min | 50 mL | 150 mL/min |
| Exchange Unit                                                                                                                                                             | max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |      |      |           |       |           |       |           |       |            |
| 5 mL                                                                                                                                                                      | 15 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |      |      |           |       |           |       |           |       |            |
| 10 mL                                                                                                                                                                     | 30 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |      |      |           |       |           |       |           |       |            |
| 20 mL                                                                                                                                                                     | 60 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |      |      |           |       |           |       |           |       |            |
| 50 mL                                                                                                                                                                     | 150 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |               |      |      |           |       |           |       |           |       |            |
| <div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> <span>min.rate</span> <span>5.0 uL/min</span> </div> <p>** titr.</p>  | <p><i>Minimum rate (0.01...999.9 uL/min)</i><br/>                     This parameter determines the rate within the control range.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |      |      |           |       |           |       |           |       |            |

| <p><b>direction:</b> auto</p>                           | <p><i>Direction is set automatically (+, -, auto)</i><br/>         auto: The direction is set automatically by the Titrino [<math>U_{init} - U_{end}</math>].<br/>         +: Direction of higher pH, higher voltage (more "positive"), higher current.s<br/>         -: Direction of lower pH, lower voltage, lower currents.<br/>         The direction is used only when "init" has been selected as start value.</p>                                                    |               |      |      |           |       |           |       |           |       |            |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------|------|-----------|-------|-----------|-------|-----------|-------|------------|
| <p><b>start V:</b> OFF</p>                              | <p><i>Type of start volume (OFF, abs., rel.)</i><br/>         "OFF": start volume switched off<br/>         "abs": absolute start volume in mL<br/>         "rel.": relative start volume to sample</p>                                                                                                                                                                                                                                                                     |               |      |      |           |       |           |       |           |       |            |
| <p><b>start V</b> 0.00 ml</p>                           | <p>If "abs." is set:<br/> <i>Absolute start volume (0...999.99 mL)</i></p>                                                                                                                                                                                                                                                                                                                                                                                                  |               |      |      |           |       |           |       |           |       |            |
| <p><b>factor</b> 0</p>                                  | <p>If "rel." is set:<br/> <i>Factor for relative start volume (0... ± 999 999)</i><br/>         Calculated using:<br/>         Start V in mL = factor * sample size</p>                                                                                                                                                                                                                                                                                                     |               |      |      |           |       |           |       |           |       |            |
| <p><b>dos.rate</b> max. ml/min<br/>         **titr.</p> | <p><i>Dosing rate for start volume (0.01...150 mL/min, max.)</i><br/>         &lt; clear &gt; sets "max."<br/>         The maximum rate depends on the Exchange Unit:</p> <table border="1"> <thead> <tr> <th>Exchange Unit</th> <th>max.</th> </tr> </thead> <tbody> <tr> <td>5 mL</td> <td>15 mL/min</td> </tr> <tr> <td>10 mL</td> <td>30 mL/min</td> </tr> <tr> <td>20 mL</td> <td>60 mL/min</td> </tr> <tr> <td>50 mL</td> <td>150 mL/min</td> </tr> </tbody> </table> | Exchange Unit | max. | 5 mL | 15 mL/min | 10 mL | 30 mL/min | 20 mL | 60 mL/min | 50 mL | 150 mL/min |
| Exchange Unit                                           | max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |      |      |           |       |           |       |           |       |            |
| 5 mL                                                    | 15 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |      |      |           |       |           |       |           |       |            |
| 10 mL                                                   | 30 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |      |      |           |       |           |       |           |       |            |
| 20 mL                                                   | 60 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |      |      |           |       |           |       |           |       |            |
| 50 mL                                                   | 150 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |      |      |           |       |           |       |           |       |            |
| <p><b>pause</b> 0 s<br/>         ** titr.</p>           | <p><i>Waiting time (0...999 999 s)</i><br/>         Waiting time, e.g. for stabilisation of the electrode after start or reaction time after dosing of a start volume. The waiting time can be aborted with &lt;QUIT&gt;.</p>                                                                                                                                                                                                                                               |               |      |      |           |       |           |       |           |       |            |
| <p><b>time interval</b> 10 s</p>                        | <p><i>Time interval (1...999 999 s)</i><br/>         Time interval for the entry of the measured values in the measuring point list. The measuring point list can contain max. 500 points.</p>                                                                                                                                                                                                                                                                              |               |      |      |           |       |           |       |           |       |            |
| <p><b>dos.element:</b> internal D0</p>                  | <p><i>Selection of dosing element (internal D0, external D1, external D2)</i><br/>         internal D0: internal buret of the Titrino<br/>         external D1/2: buret D1, D2, resp.</p>                                                                                                                                                                                                                                                                                   |               |      |      |           |       |           |       |           |       |            |

|                       |    |                         |    |                      |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
|-----------------------|----|-------------------------|----|----------------------|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>meas. input:</b> 1 | or | <b>I(pol)</b> 1 $\mu$ A | or | <b>U(pol)</b> 400 mV | <b>electrode test:</b> OFF | <p><i>Measuring input (1, 2, diff.)</i><br/>         Measuring input for pH and U. Measuring input 1 or 2 or differential amplifier; connection of electrodes, see page 187.</p> <p>With polarized electrodes, the request of the measuring input is replaced by one regarding the<br/> <i>polarization current (-127...127 <math>\mu</math>A),</i><br/>         or the<br/> <i>polarization voltage (-1270...1270 mV, in steps of 10 mV)</i></p> <p><i>Electrode test (OFF, ON)</i><br/>         Test for polarized electrodes. Performed on the switchover from the inactive basic status to a measurement. "OFF" means the test is not performed.</p> |  |
|                       |    |                         |    |                      |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
|                       |    |                         |    |                      |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
|                       |    |                         |    |                      |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |

|                            |                                                                                                                                                                                                                                                              |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>temperature</b> 25.0 °C | <p><i>Temperature (-170.0...500.0 °C)</i><br/>         If a T sensor is connected, the temperature is measured continuously and the pH values are corrected accordingly.<br/>         The last measured value is entered as the "temperature" parameter.</p> |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                            |                        |
|----------------------------|------------------------|
| <b>&gt;stop conditions</b> | <b>Stop conditions</b> |
|----------------------------|------------------------|

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>stop V:</b> abs.    | <p><i>Type of stop volume (abs., rel., OFF)</i><br/>         "abs": absolute stop volume in mL<br/>         "rel.": relative stop volume to sample size.<br/>         "OFF": stop volume switched off, not monitored.</p> <p>If "abs." is set:<br/> <i>Absolute stop volume (0...9999.99 mL)</i></p> <p>If "rel." is set:<br/> <i>Factor for relative stop volume (0... ± 999 999)</i><br/>         Calculated using:<br/>         Stop V in mL = factor * sample size</p> |
| <b>stop V</b> 99.99 ml |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>factor</b> 999999   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

| <b>filling rate max. ml/min</b> | <p><i>Filling rate (0.01...150 mL/min, max.)</i><br/>         &lt;clear&gt; sets "max."<br/>         The maximum rate depends on the Exchange Unit:</p> <table style="margin-left: 20px;"> <thead> <tr> <th style="text-align: left;">Exchange Unit</th> <th style="text-align: left;">max.</th> </tr> </thead> <tbody> <tr> <td>5 mL</td> <td>15 mL/min</td> </tr> <tr> <td>10 mL</td> <td>30 mL/min</td> </tr> <tr> <td>20 mL</td> <td>60 mL/min</td> </tr> <tr> <td>50 mL</td> <td>150 mL/min</td> </tr> </tbody> </table> | Exchange Unit | max. | 5 mL | 15 mL/min | 10 mL | 30 mL/min | 20 mL | 60 mL/min | 50 mL | 150 mL/min |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------|------|-----------|-------|-----------|-------|-----------|-------|------------|
| Exchange Unit                   | max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |      |      |           |       |           |       |           |       |            |
| 5 mL                            | 15 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |      |      |           |       |           |       |           |       |            |
| 10 mL                           | 30 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |      |      |           |       |           |       |           |       |            |
| 20 mL                           | 60 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |      |      |           |       |           |       |           |       |            |
| 50 mL                           | 150 mL/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |      |      |           |       |           |       |           |       |            |

|                                            |                                                                                                                                                                                                                                                                 |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>&gt;statistics</b>                      | <b>Statistics calculation</b><br>Mean value, absolute and relative standard deviation, see page 76.                                                                                                                                                             |
| <b>status:</b> OFF                         | <i>Status of statistics calculation (OFF, ON)</i><br>If the statistics calculation is switched off, the following requests do not appear.                                                                                                                       |
| <b>mean</b> n= 2                           | <i>Mean value calculation from n individual results (2...20)</i>                                                                                                                                                                                                |
| <b>res.tab:</b> original                   | <i>Result table (original, delete n, delete all)</i><br>"original": The original table is used. Deleted results are reincorporated in the evaluation.<br>"delete n": Deletes individual results with the index n.<br>"delete all": The entire table is deleted. |
| <b>delete</b> n= 1                         | <i>Delete data from sample number n (1...20)</i><br>The deleted result is removed from the statistics calculation.                                                                                                                                              |
| <b>&gt;monitoring</b>                      | <b>Monitoring of measured values</b><br>Limit value violations are marked in the measuring point list.                                                                                                                                                          |
| <b>meas.val:</b> OFF                       | <i>Monitoring of measured values (ON, OFF)</i>                                                                                                                                                                                                                  |
| <b>**titr.</b><br><b>low lim.pH</b> -20.00 | <i>Limits for measured values (input range depends on measured quantity:</i>                                                                                                                                                                                    |
| <b>**titr.</b><br><b>up lim.pH</b> 20.00   | <i>pH: 0... ± 20.00<br/>U, Ipol: 0... ± 2000 mV<br/>Upol: 0... ± 200.0 uA)</i>                                                                                                                                                                                  |
| <b>**titr.</b><br><b>action:</b> none      | <i>Action if a limit is exceeded (end, hold, wait, none)</i><br>end: Abort<br>hold: Hold reagent addition until manually restarted.<br>wait: Hold reagent addition until limits are again complied with, then continue automatically.                           |
| <b>**titr.</b>                             |                                                                                                                                                                                                                                                                 |

|                                                          |                                                                                                                                                                                                                       |
|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>temperature:</b>      <b>OFF</b></p>               | <p><i>Monitoring of temperature (ON, OFF)</i></p>                                                                                                                                                                     |
| <p>**titr.<br/><b>low lim.</b>      <b>-170.0 °C</b></p> | <p><i>Limits for measured values (-170.0...500.0 °C)</i></p>                                                                                                                                                          |
| <p>**titr.<br/><b>up lim.</b>      <b>500.0 °C</b></p>   | <p><i>Action if a limit is exceeded (end, hold, wait, note)</i></p>                                                                                                                                                   |
| <p>**titr.<br/><b>action:</b>      <b>none</b></p>       | <p>end: Abort<br/>hold: Hold reagent addition until manually restarted.<br/>wait: Hold reagent addition until limits are again complied with, then continue automatically.</p>                                        |
| <p><b>assign output:</b>      <b>none</b></p>            | <p><i>Assignment of output L4 for monitoring. (meas, temp, all, none)</i><br/>Output L4 (pin 3) of a signal of the remote socket if a limit value has been exceeded.</p>                                              |
| <p><b>L4 output:</b>      <b>pulse</b></p>               | <p><i>Type of signal at L4 output (active, pulse) of the remote socket:</i><br/>active: Output line is set to 0 V.<br/>pulse: Pulse &gt; 100 ms.<br/>Important: A active line is set inactive through an impulse!</p> |
| <p><b>&gt;preselections</b></p>                          | <p><b>Preselections for the sequence</b></p>                                                                                                                                                                          |
| <p><b>req.ident:</b>      <b>OFF</b></p>                 | <p><i>Request of sample identifications after start (id1, id1 &amp; 2, all, OFF)</i><br/>After start sample identifications can be requested automatically: Only id1, id 1 &amp; 2, all three ids or no requests.</p> |
| <p><b>req.smp1 size:</b>      <b>OFF</b></p>             | <p><i>Request of sample size after start (value, unit, all, OFF)</i><br/>With "all" first the value, then the unit is requested.</p>                                                                                  |
| <p><b>display rate :</b>      <b>OFF</b></p>             | <p><i>Display current rate during the sequence (ON, OFF)</i><br/>The rate is displayed instead of the temperature.</p>                                                                                                |
| <p><b>activate pulse:</b>      <b>OFF</b></p>            | <p><i>Pulse output "activate" (L6, pin 1) of the remote socket (ON, OFF)</i><br/>see page 194.</p>                                                                                                                    |

## Sequence with DOC

The start of the sequence depends on the application and can be configured with the following parameters (see schematic representation below):

- Start delay (setting under <configuration>, >auxiliaries)
- Request of sample identifications and sample size following titration start

<START>

(output activate pulse)

(start delay)

(request ident.)

(request sample size)

(start V, pause)

Control  
Measuring point list  
(Monitoring)

Stop

Data output

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

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

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

The control starts. Measuring points (time, volume) are entered in the measuring point list. Limit values are checked if monitoring is active and the measured values and/or the temperature entered in the measuring point list. Violations of the limit values are marked in the measuring point list.

The temperature is measured continuously, i.e. a T measuring is carried out every 2 s. If no T sensor is connected, only measured values are recorded (without interruption by the temperature measurement) and the temperature set manually holds.

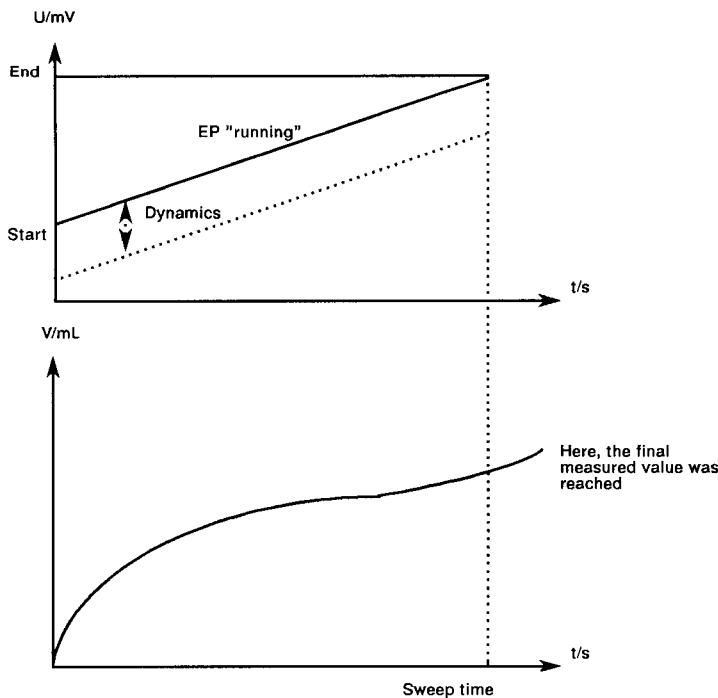
Stop is effected when the measured value ramp has been swept, i.e. when the sweep time is reached. If the measured value monitoring is active, the current measured value must have attained the end of the ramp.

Finally, the data are put out. If a printer is connected, see page 78. The measuring point list forms the basis for the graphics.

## Measured value ramp

In DOC the set value of a measured quantity is changed linearly from a start value to a final value during a preset sweep time (measured value gradient). The reagent addition is 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 value lies outside the control range, the reagent addition rate is determined primarily by the parameter "max.rate".
- If the current measured value lies within the control range, the reagent addition rate is determined primarily by the parameter "min.rate".

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

## Measuring point list and monitoring

- Measured points are entered in the measuring point list at the preset time interval. The inputted times represent the clock time. This must be distinguished from the dispensing time: The dispensing time does not include any wait times which can arise in refilling, hold or wait as a result of limit value violations.
- If one (or more) entries occur in the time during refilling, one measured point is entered immediately after the refilling. The time reference otherwise remains unchanged, however.
- The measuring point list always includes the values "time" and "volume". If monitoring of measured values and/or temperature is active, the corresponding values are also entered.
- The "mess." column shows a message if a limit value was violated in the last time interval, see example of a measured point list on page 52. "\*" 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 volume of the last entry of the measuring points can be different of the end volume, because time can be passed by between the last entry and t(delay).

## 2.6.7 Parameters for MEAS

| >measuring parameters                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Measurements parameters                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>signal drift</b>    OFF mV/min                 </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p><i>Drift criterion for measured value acquisition (input range depends on the measured quantity:</i><br/>                     pH, U, Ipol:    0.5...999 mV/min, OFF<br/>                     Upol:            0.05...99.9 uA/min, OFF<br/>                     T:                0.5...999 °C/min, OFF)<br/>                     &lt;clear&gt; sets "OFF".<br/>                     "OFF" means that the measured value is acquired after a fixed equilibration time.</p>                                                                                                                                                                                                                                       |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>equilibr.time</b>    OFF s                 </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p><i>Waiting time for measured value acquisition (0...9999 s, OFF)</i><br/>                     &lt;clear&gt; sets "OFF".<br/>                     If no new equilibration time has been entered, the Titrino calculates an equilibration time appropriate to the drift with the formula</p> $\text{equilibr.time (in s)} = \frac{150}{\sqrt{\text{drift} + 1}} + 5$ <p>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.</p>                                                                                                                                                                                   |
| <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 5px;"> <b>meas. input:</b>            1                 </div> <p style="text-align: center;">or</p> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 5px;"> <b>I(pol)</b>                    1 uA                 </div> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 5px;"> <b>U(pol)</b>                    400 mV                 </div> <p style="text-align: center;">or</p> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>electrode test:</b>        OFF                 </div> | <p><i>Measuring input for pH and U. (1, 2, diff.)</i><br/>                     Inquiry only with measured quantities pH and U. Measuring input 1 or 2 or differential amplifier; connection of electrodes, see page 187.</p> <p>With polarized electrodes, instead of the measuring input the<br/> <i>polarization current (-127...127 μA)</i><br/>                     or the<br/> <i>polarization potential (-1270...1270 mV, in steps of 10 mV)</i><br/>                     is inquired.<br/> <i>Electrode test (OFF, ON)</i><br/>                     Test for polarized electrodes. Performed on changeover from the inactive standby mode to a measurement. "OFF" means that the test is not performed.</p> |
| <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>temperature</b>            25.0 °C                 </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p><i>Temperature (-170.0...500.0C)</i><br/>                     Temperature is measured at the the start if a T sensor is connected.<br/>                     This parameter is used for temperature compensation in pH measurements.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

**>statistics**

**Statistics calculation**

Mean value, absolute and relative standard deviation, see also page 76.

**status: OFF**

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

**mean n= 2**

*Number n of single values for statistics (2...20)*

**res.tab: original**

*Result table (original, delete n, delete all).*  
"original": The original table is used.  
Single deleted results are again incorporated in the evaluation.  
"delete n": Delete of single results with the index n.  
"delete all": The entire table is deleted.

**delete n= 1**

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

**>preselections**

**Preselections for the sequence**

**req.ident: OFF**

*Request of sample identifications after start (id1, id1 & id2, 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 (value, unit, all, OFF)*

**activate pulse: OFF**

*Pulse output on the line "activate" (L6, pin1) of the remote socket (ON,OFF)*  
see page 194.

## 2.6.8 Parameters for CAL

| <b>&gt;calibration parameters</b> | <b>Calibration parameters</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                      |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <b>meas.input:</b> 1              | <i>Measuring input (1, 2, diff.)</i><br>Measuring input 1 or 2 or differential amplifier;<br>Connection of electrodes, see page 187.                                                                                                                                                                                                                                                                                               |                                                                                                                                      |
| <b>cal.temp.</b> 25.0 °C          | <i>Calibration temperature (-20.0 ... 120.0 °C)</i><br>The calibration temperature can also be<br>inputted during the calibration sequence.                                                                                                                                                                                                                                                                                        |                                                                                                                                      |
| <b>buffer 1 pH</b> 7.00           | <i>pH value of first buffer (0... ± 20.00)</i><br>The pH value of the buffers can be put in<br>during the calibration sequence.                                                                                                                                                                                                                                                                                                    |                                                                                                                                      |
| <b>buffer 2 pH</b> 4.00           |                                                                                                                                                                                                                                                                                                                                                                                                                                    | <i>pH value of second and the following buffers<br/>           (0... ± 20.00, OFF)</i>                                               |
| <b>buffer 3 pH</b> OFF            |                                                                                                                                                                                                                                                                                                                                                                                                                                    | <i>&lt;clear&gt; sets "OFF".</i><br>Buffers are requested until "OFF" is set. This<br>gives an n-point calibration. Up to 9 buffers. |
| <b>signal drift</b> 2 mV/min      | <i>Drift for measured value acquisition (0.5...999<br/>           mV/min, OFF)</i><br><i>&lt;clear&gt; sets "OFF".</i><br>"OFF" means that the measured value is<br>acquired after an equilibration time.                                                                                                                                                                                                                          |                                                                                                                                      |
| <b>equilibr.time</b> 110 s        | <i>Equilibration time (0...9999 s, OFF)</i><br><i>&lt;clear&gt; sets "OFF".</i><br>If a new equilibration time has not been en-<br>tered, the Titrino calculates an equilibration time<br>appropriate to the drift, see page 18. The mea-<br>sured value is acquired as soon as the first cri-<br>terion (drift or time) has been met.<br>If drift and time are both set to "OFF", the<br>measured value acquisition is immediate. |                                                                                                                                      |
| <b>electr.id</b>                  | <i>Electrode identification (up to 8 characters).</i>                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                      |
| <b>sample changer cal:</b> OFF    | <i>Calibration with sample changer (ON, OFF)</i><br>In calibrations with a sample changer, there are<br>no hold points in the calibration sequence for<br>inputs. Calibration temperature and pH values<br>of the buffers (which are temperature<br>dependent) must therefore be entered in<br>advance.                                                                                                                            |                                                                                                                                      |
| <b>activate pulse:</b> OFF        | <i>Pulse output on the line "activate" (L6, pin 1) of<br/>           the remote socket (all, first, OFF)</i><br>See page 194.                                                                                                                                                                                                                                                                                                      |                                                                                                                                      |

## Calibration sequence

|                                                       |                                                                                                                                                                                                |
|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>&lt; START &gt;</p>                                | <p>Immerse electrode in first buffer solution.</p> <p>Start calibration.</p>                                                                                                                   |
| <p>(Output activate pulse)</p>                        | <p>Before the calibration, possibly an activate pulse is put out and a start delay is attened.</p>                                                                                             |
| <p>(Start delay)</p>                                  | <p>(Setting in &lt; configuration &gt; , &gt; auxiliaries)</p>                                                                                                                                 |
| <p>Measure cal. temp.<br/>or<br/>input cal. temp.</p> | <p>Then the calibration temperature is measured<br/>or<br/>if no temperature sensor is connected, it must be entered. Confirm value with &lt; enter &gt; or advance with &lt; START &gt; .</p> |
| <p>Buffer 1 pH</p>                                    | <p>Entry of the pH value of the 1st buffer. Accept value with &lt; enter &gt; or advance with &lt; START &gt; .</p>                                                                            |
| <p>Measure buffer 1</p>                               | <p>The first buffer is measured.</p>                                                                                                                                                           |
| <p>Buffer 2 pH</p>                                    | <p>Entry of the pH value of the 2nd buffer. Accept value with &lt; enter &gt; or advance with &lt; START &gt; .<br/>or<br/>quit the calibration with &lt; STOP &gt; → 1-point calibration.</p> |
| <p>(Measure buffer 2)</p>                             | <p>The second buffer is measured.</p>                                                                                                                                                          |
| <p>etc.</p>                                           | <p>As many buffers appear as have been specified under the &lt; parameters &gt; key (up to 9).<br/>The calibration can be terminated at any time with &lt; STOP &gt; .</p>                     |
| <p>Data output</p>                                    | <p>The calibration data appear in the display. If you have a printer connected, see page 78.</p>                                                                                               |

The calibration data are available for calculation:

C46: pHas

C47: Electrode slope

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

Calibration data can be viewed at any time with the < cal.data > key (see page 88) 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 81.

|                           |                                                                                                                                                                                                                                                                      |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>&gt;sequence</b>       | <b>Parameters for the sequence</b><br>see page 81.                                                                                                                                                                                                                   |
| <b>&gt;statistics</b>     | <b>Statistics calculation</b><br>Mean value, absolute and relative standard deviation, see also page 76.                                                                                                                                                             |
| <b>status:</b> OFF        | <i>Status of statistics calculations (OFF, ON)</i><br>If the statistics calculation is switched off, the following inquiries regarding the statistics do not appear.                                                                                                 |
| <b>mean</b> n= 2          | <i>Mean value calculation from n single results (2...20)</i>                                                                                                                                                                                                         |
| <b>res.tab:</b> original  | <i>Result table (original, delete n, delete all)</i><br>"original": The original table is used.<br>Deleted results are again incorporated in the evaluation.<br>"delete n": Delete of single results with the index n.<br>"delete all": The entire table is deleted. |
| <b>delete</b> n= 1        | <i>Delete data from sample number n (1...20)</i><br>The deleted result is removed from the statistics calculation.                                                                                                                                                   |
| <b>&gt;preselections</b>  | <b>Preselections for the sequence</b>                                                                                                                                                                                                                                |
| <b>req.ident:</b> OFF     | <i>Request of sample identifications after start (id1, id1 &amp; id2, all, OFF)</i><br>After start, sample identifications can be inquired automatically: Only id1, id1 & id2, all three id's or no inquiries.                                                       |
| <b>req.smp1 size:</b> OFF | <i>Request of sample size after the start (value, unit, all, OFF)</i>                                                                                                                                                                                                |

meas.mode: OFF

*Measured quantity (pH, U, I<sub>pol</sub>, U<sub>pol</sub>, T, OFF)*  
Measured 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 187.

or

I(pol) 1 uA

or

U(pol) 400 mV

With polarized electrodes, instead of the measuring input the  
*polarization current (-127...127 uA)*  
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

*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, <def> key

|                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |          |                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------------------------|
|                                                                                                                      | <p>With the &lt;def&gt; key, you can enter formulas for the result calculation. The formulas are specific to a method and are stored in the method memory.</p>                                                                                                                                                                                                                                                                                                                    |          |                          |
| <table border="1" style="width: 100%;"> <tr> <td style="background-color: #cccccc; text-align: center;">&gt;Formula</td> <td style="text-align: center;"><b>Input of formulas</b></td> </tr> </table> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | >Formula | <b>Input of formulas</b> |
| >Formula                                                                                                                                                                                              | <b>Input of formulas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                          |          |                          |
| <div style="border: 1px solid black; padding: 5px; width: fit-content;">RS?</div>                                                                                                                     | <p><i>Enter formula number (1...9)</i><br/>You can calculate up to 9 results per method. Enter a number 1...9.</p>                                                                                                                                                                                                                                                                                                                                                                |          |                          |
| <div style="border: 1px solid black; padding: 5px; width: fit-content;">RS1=</div>                                                                                                                    | <p><i>Input of formula</i><br/>Example:<br/>RS1 = EP1*C01/C00<br/>Enter formula by means of 3rd functions of keyboard and confirm with &lt;enter&gt;. Here you will find operands, mathematical operations and parentheses. Operands require a number as an identification. You can use the following operands:<br/>EPX: EP's. X = 1...9<br/>RSX: Results which have already been calculated with previous formulas. X = 1...9.<br/>CXX: Calculation constants. XX = 00...89.</p> |          |                          |
| <div style="border: 1px solid black; padding: 5px; width: fit-content;">RS1=EP1*C01/C00</div>                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |          |                          |

#### Meaning of the callculation variables CXX:

- C00 Sample size, see page 89.
- C01 Method specific operands, see page 75. They are stored with the method in the  
: method memory.
- C19
- C21 Sample-specific operands, see page 89ff.  
:
- C23
- C26, 27: Mean values from silo calculations.
- C3X Common variables, X = 0...9.
- C40 Initial measured value of the sample.
- 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).
- C5X Fix EP for DET and MET or Fix V for STAT, X = 1...9.
- C6X pK/HNP values for DET and MET or Fix V for STAT, X = 1...9
- C7X Temporary variables for calculations in TIP, X = 1...9.
- C80 Mean rate for STAT.
- C8X Rates, evaluated in preset time windows for STAT, X = 1...9.

Rules:

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

If a formula is stored with <enter>, result text, number of decimales 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)

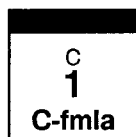
|           |   |
|-----------|---|
| RS1 unit: | % |
|-----------|---|

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).

|     |  |
|-----|--|
| RS? |  |
|-----|--|

Enter next formula, e.g. for RS2.

### 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> <select> (press key repeatedly until "calc" appears in the display) <enter>.

## 2.8 Statistics calculation

Mean values, absolute and relative standard deviations are calculated.

### Allocations for the statistics calculation, key <def>

|                                                                                   |                                                                                                                                                                       |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>The &lt;def&gt; key is used to allocate results for statistics calculation.</p> <p>The entries are specific to the method and are stored in the method memory.</p> |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                            | <h3>Allocations for statistics calculations</h3>                                                                                                                                                                                                                                                                                                                                  |
| <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">MN? =</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">MN2 =</div> <div style="border: 1px solid black; padding: 5px;">MN2=RS2</div> | <p><i>Number n of single values for statistics calculation. (1...9)</i></p> <p>You can perform statistics calculation using up to 9 results (RSX), endpoints (EPX) or variables (CXX). For MN1, the default value RS1 is entered.</p> <p>Enter a number 1...9.</p> <p><i>Allocation of a size (RSX, EPX, CXX)</i></p> <p>Delete allocation with &lt;clear&gt; + &lt;enter&gt;</p> |

### How do you obtain statistics calculations?

- 1) Enter the allocations for the statistics calculation, see above.
- 2) Switch on the statistics calculations: Either with <statistics> or set the status under <parameters>, "> 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", ev.
- 4) Perform at least 2 titrations. The statistics calculation are constantly updated and put out. The values are printed in the short and full result report or displayed: Press <select> until the display shows "display mean". Display the mean values with <enter>. Proceed in the same manner for the absolute standard deviations.

#### Rules:

- Recalculated results are incorporated in the statistics calculation.
- If a result of a particular titration can not be calculated, no results for this determination are incorporated in the statistics calculation. However, the sample counter is still operative, i.e. the statistics 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 (see page 16), 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" (<parameters>, "> statistics", "res.tab:").
- The individual results of the statistics table can be printed with <print> <statistics> <enter>.

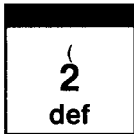
## 2.9 Common variables

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 <configuration> .

### Allocations for common variables, key <def>



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

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

>common variables

#### Allocation for common variables

C3? =

*Common variable C3? (0...9)*

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

C30 =

Enter a number.

C30=RS1

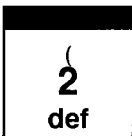
*Allocation of a size (RSX, EPX, CXX, MNX)*


The values of the common variables remain in force for all methods until they are overwritten or deleted. They can be viewed under the <configuration> key, see page 9.

Delete allocation with <clear> + <enter> .

## 2.10 Data output

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

|                                                                                   |                                                                                                                                                                             |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>With &lt;def&gt;, the report sequence at the end of the determination is defined.</p> <p>The entries are specific to the method and are stored in the method memory.</p> |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                   | <b>Definition of the report sequence on completion of a determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <div style="border: 1px solid black; padding: 5px; margin-bottom: 20px;"> <p><b>report:</b></p> </div> <div style="border: 1px solid black; padding: 5px;"> <p><b>report:full;curve</b></p> </div> | <p><i>Reportsequenz (Eingabebereich abhängig vom Mode:</i></p> <p><b>DET:</b> <i>full, short, mplist, curve, derive, comb, scalc full, scalc srt, param, calc, calib, ff</i></p> <p><b>MET:</b> <i>full, short, mplist, curve, scalc full, scalc srt, param, calc, calib, ff</i></p> <p><b>STAT, DOC:</b><br/><i>full short, mplist, curve, meas crv, temp crv, scalc full, scalc srt, param, calc, calib, ff</i></p> <p><b>DOS:</b> <i>full, short, mplist, curve, meas crv, temp crv, scalc full, scalc srt, param, calc, ff</i></p> <p><b>SET, MEAS, CAL:</b><br/><i>full, short, scalc full, scalc srt, param, calc, calib, ff</i></p> <p><b>KFT, TIP:</b><br/><i>full, short, scalc full, scalc srt, param, calc, ff</i></p> <p>Select a block. If you require more than one report block, set a ";" as a delimiter between the blocks.</p> |

#### 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) resp. volume against time (with STAT, DOS and DOC) |
| 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 temp active).             |
| scalc full | Full report of silo calculations.                                                     |
| scalc srt  | Short report of silo calculations.                                                    |
| param      | Parameter report.                                                                     |
| calc       | Report with formulas and operands.                                                    |
| calib      | Calibration data.                                                                     |
| ff         | Form feed on printer.                                                                 |

Original reports which are 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> .

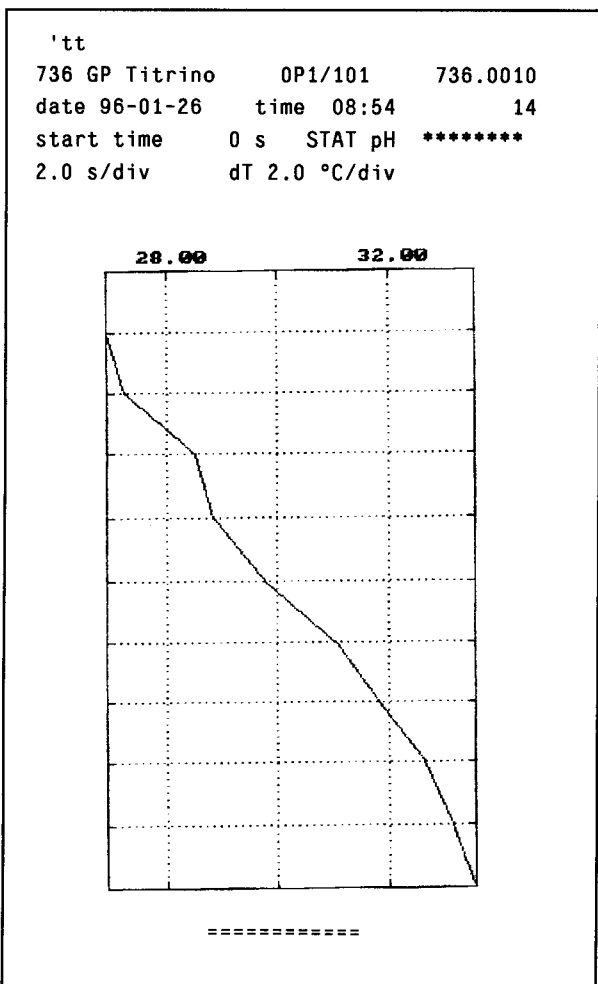
Example of reports:

```
'fr
736 GP Titrino    OP1/101    736.0010
date 96-01-26    time 08:54    14
card label: Appl.736
pH(init)        2.88    DET pH *****
smp1 size       0.372 g
EP1             2.083 ml    7.64
RS1             3.80 g/l
device label    Titr 1    sign:
=====
```

Full result report.

Card label, if the card is inserted, see page 87.

Device label, see page 8 and manual signature.



Example of a temperature curve in STAT (report temp crv).

In order to obtain such a curve, the temperature monitoring has to be active. If the limit values lie in the range of the measurement, the limit will be marked in the curve as well.

Sequence of the temperature vs. time.

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

## Additional possibilities for report outputs

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

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

List of the "key X":

| Report                                                                                                                  | <key X>       |
|-------------------------------------------------------------------------------------------------------------------------|---------------|
| Configuration report                                                                                                    | configuration |
| Parameter report                                                                                                        | parameters    |
| Current sample data                                                                                                     | smpl data     |
| Statistics report with the individual results                                                                           | statistics    |
| All sample data from the silo memory                                                                                    | silo          |
| Calibration data                                                                                                        | cal.data      |
| 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 methods  |
| Complete report sequence of the last determination, as defined under the <def> key in the method                        | reports       |

## Result display without printer

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

| <select>: display               | <enter>: display          | Remarks                                     |
|---------------------------------|---------------------------|---------------------------------------------|
| > display results               | RS1...RS9                 | calculated results                          |
| > display EP's                  | EP1...EP9                 |                                             |
| > display rates                 | C81...C89                 | Rates in time windows (STAT)                |
| > display fix EP's resp. fix V  | C51...C59                 | Interpolated volumes                        |
| > display pK/HNP resp. fix time | C61...C69                 |                                             |
| > display mean                  | m(RS1)...m(RS9), n        | mean values and number of individual values |
| > display std.deviation         | s(RS1)...s(RS9)           | absolute standard deviation                 |
| > display messages              |                           | various (error) messages                    |
| > display meas.val              | C40                       | with MEAS                                   |
| > display calibration           | slope and pHas            | with CAL                                    |
| > display temp. variables       | C70...C79                 | with TIP                                    |
| > display other values          | volume, dosing time, rate | with DOS                                    |

## 2.11 TIP, Titration Procedure

TIP (Titration Procedure) 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 determination sequence

|                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>&lt;def&gt;</p> <p><b>&gt;sequence</b></p> <p>&lt;enter&gt;</p> <p><b>1.step: OFF</b></p> <p>&lt;enter&gt;</p> <p><b>1.method: 5-TIP</b></p> <p>&lt;enter&gt;</p> <p>&lt;etc..&gt;</p> <p>2 x &lt;QUIT&gt;</p> | <p>Press &lt;def&gt;</p> <p>and when "&gt;sequence" is displayed</p> <p>&lt;enter&gt;.</p> <p>Use &lt;select&gt; to choose the 1st step of the TIP sequence: method, pause, L4 output, L6 output or info.</p> <p>method: Method from the user memory.<br/>         pause: Wait time<br/>         L4, L6 output: Set an output.<br/>         Info: Hold sequence and write a message into the display.<br/>         Prep Preparation of titrating burets.</p> <p>Confirm the step with &lt;enter&gt; and enter the parameter for the selected step, see below.</p> <p>The request for the second step follows etc. Up to 30 steps can be selected.</p> <p>On completion of the sequence definition, exit the inquiry with &lt;QUIT&gt;.</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

The following commands can be used:

| Command       | Meaning                                                                                                                                                                                                                                                                                                                                                                                    | Input range                           |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| Method        | Method from the user memory. This method runs as a submethod.                                                                                                                                                                                                                                                                                                                              | Name                                  |
| Pause         | Waiting time. The waiting time can be stopped 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<br>active = 0 V, inactive = 5 V, pulse > 100 ms, off = output is not used.<br>Cable Titrino (L6) – Dosimat: 6.2139.000.<br>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 .<br>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 |

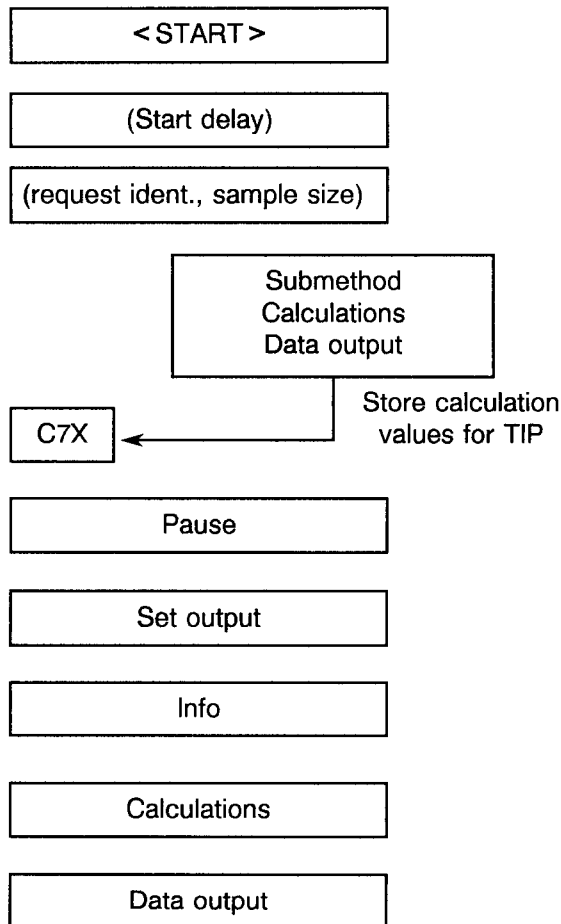
The parameters of the sequence can be viewed and changed at any time under the <parameters> key .

### Sequence of TIP

As there is no preset sequence of TIP, in what follows the procedure is illustrated by a sequence that contains all available commands.

The start of the sequence depends on the application and can be configured with the following parameters (see schematic representation below):

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



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

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

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

Pause time allowed to elapse.

Outputs of the remote socket can be set.

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

Higher level calculations in TIP.

Data output in TIP (TIP contains no more determination data, i.e. curves must be 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:

|                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>6 x &lt;def &gt;</p> <p>&gt;temporary variables</p> <p>&lt;enter &gt;</p> <p>C7?</p> <p>2 x &lt;QUIT &gt;</p> | <p>Press &lt;def &gt; repeatedly until " &gt;temporary variable" appears in the display,</p> <p>than press</p> <p>&lt;enter &gt; .</p> <p>Store temporary variables from C70...C79:<br/>Enter a number between 0 and 9. Assign the quantity from the submethod which should be used in the TIP calculations: Endpoints EPX, results RSX or variables CXX.</p> <p>Leave the request with &lt;QUIT &gt; and store the submethod in the user memory.</p> |
|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|








## Calculations in TIP

Variables C7X can be performed from different submethods in TIP general calculations, formula entry see page 74.

Note:

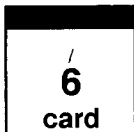
We recommend to execute the calculations in TIP, as the "dry" determinations can only be recalculated here, e.g. with a different sample size.

## 2.12 Method memory, keys <user meth> and <card>

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | Management of the internal method memory with <user meth> .<br>Select method name with <select> or by entering its name.                                                                                                                                                                                                                                               |
|    | <b>Recall method</b>                                                                                                                                                                                                                                                                                                                                                   |
|    | <i>Recall method from the internal method memory to the working memory (input of method name, which is included in the memory).</i><br>Selection of method name with <select> .<br>If a method identification is entered which is not found in the method memory, the selected value blinks.                                                                           |
|    | <b>Store method</b>                                                                                                                                                                                                                                                                                                                                                    |
|  | <i>Store method from the working memory to the internal method memory (up to 8 ASCII characters).</i><br>Text input see page 17.<br>If a method 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.                                                                     |
|  | <b>Delete method</b>                                                                                                                                                                                                                                                                                                                                                   |
|  | <i>Delete method from the internal method memory (input of method name, which is included in the memory).</i><br>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.<br>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 6.6022.000 menu 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.



Management of the method memory on the card with < card > .  
Select names with < select > or by entering their name.

### 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 6.6023.000.

### 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.

**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 expiry date of the card). 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 > < select > < enter > ; press < select > as many times as "card" appears in the display.

### Ordner designations

Memory card with 128 KBytes memory space  
Application card with application file

6.2245.010  
6.6023.000

|                                                     |                                                                                                                                                                                                                                                          |
|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>&gt;recall method</b></p> <p>method:</p>      | <p><b>Recall method</b></p> <p><i>Recall method from the current directory of the card to the working memory</i><br/>Identical function as for internal method memory.</p>                                                                               |
| <p><b>&gt;store method</b></p> <p>method:</p>       | <p><b>Store method</b></p> <p><i>Store method from the working memory to the current directory of the card (up to 8 characters)</i><br/>Identical function as for internal method memory.</p>                                                            |
| <p><b>&gt;delete method</b></p> <p>method:</p>      | <p><b>Delete method</b></p> <p><i>Delete method from the current directory of the card</i><br/>Identical function as for internal method memory.</p>                                                                                                     |
| <p><b>&gt;change directory</b></p> <p>dir.name:</p> | <p><b>Change current directory</b><br/><i>(directory name with up to 10 characters)</i><br/>The functions "recall method", "store method" and "delete method" access to the current directory.</p>                                                       |
| <p><b>&gt;Create directory</b></p> <p>dir.name:</p> | <p><b>Create new directory</b><br/><i>(directory name with up to 10 characters)</i></p>                                                                                                                                                                  |
| <p><b>&gt;delete directory</b></p> <p>dir.name:</p> | <p><b>Delete directory</b><br/><i>(directory name with up to 10 characters)</i><br/>The directory and all methods of the directory are deleted.</p>                                                                                                      |
| <p><b>&gt;backup</b></p> <p>dir.name:</p>           | <p><b>Backup of the internal method memory on the card</b><br/><i>(directory name with up to 10 characters)</i><br/>Existing methods in this directory will be deleted, and all methods from the internal method memory are stored in the directory.</p> |

**>reload**

**dir.name:**

**Reload methods from the card to the internal method memory**

*(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**

**card label:**

**format:**

**Format the card**

*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 79).

*Confirmation of formatting the card (ON, OFF)*

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**

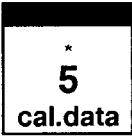
**date**




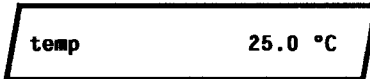

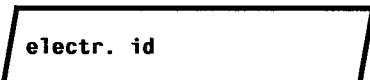

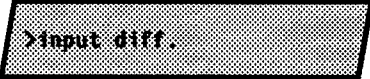
**Battery change date**

*Date for changing the battery (YYYY-MM-DD)*

see page 85.

## 2.13 Calibration data, key <cal.data>

|                                                                                   |                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>With &lt;cal.data&gt;, the current pH calibration data of all measuring inputs can be seen. Calibration data are entered here automatically on completion of a calibration.</p> |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                     |                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <p><b>Measuring input 1</b></p>                                                                                                                                                                            |
|    | <p><i>Asymmetry pH (0... ± 20.00)</i><br/>Entered automatically after a calibration with measuring input 1.</p>                                                                                            |
|    | <p><i>Slope (0... ± 9.999)</i><br/>Entered automatically after a calibration on measuring input 1.</p>                                                                                                     |
|   | <p><i>Temperature(-20.0...120.0 °C)</i><br/>Will be printed automatically after calibration with the entry of measure 1.</p>                                                                               |
|  | <p><i>Date of last calibration (no entry possible)</i><br/>If the calibration data "pH(as)" and/or "slope" are changed by a manual entry, the date entry is deleted.</p>                                   |
|  | <p><i>Electrode identification of calibrated electrodes (no entry possible)</i><br/>If an electrode identification has been entered in the CAL mode, the entry is automatically after the calibration.</p> |
|  | <p><b>Measuring input 2</b><br/>Identical as for measuring input 1.</p>                                                                                                                                    |
|  | <p><b>Differential measuring input</b><br/>Identical as for measuring input 1.</p>                                                                                                                         |

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

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

## 2.14 Current sample data, key < smpl data >

**smpl  
data**

< 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 90.

Instead of entering the current sample data with < smpl data >, you can request these function automatically after start of determinations. Configuration: < parameters > and select " >preselections".

Current sample data can be entered live. For working with the silo memory see page 90.

id#1 or C21

id#2 or C22

id#3 or C23

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

Sample identifications or sample specific operands can be entered using the keypad or via a balance with a special input device (see page 182).

smpl size                      1 g

*Sample size (6-digit number: ± X.XXXXX)*

Entry using keypad or via a balance (see page 182).

smpl unit:                      g

*Unit of sample size (g, mg, ml, ul, pc, no unit or up to 5 characters)*

Selection with <select>.

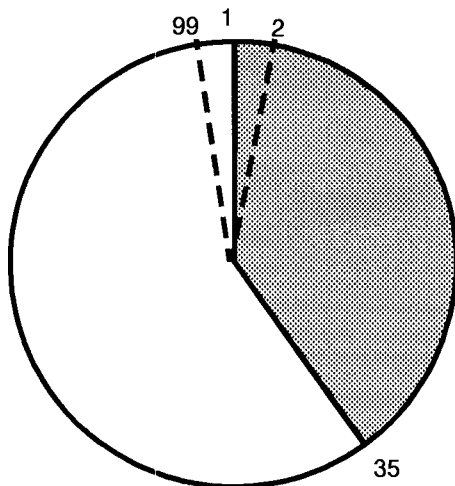
## 2.15 Silo memory for sample data

In the silo memory or pushup storage, sample data (method, identifications and smpl size) can be stored. This is useful, e.g. when you work with sample changers and other automatic sample addition systems or if you wish an overview of your determination results, see page 93.

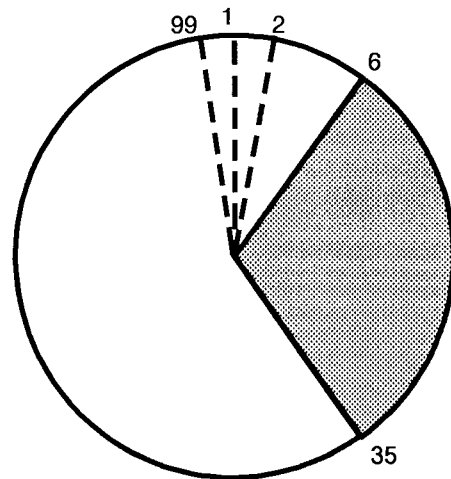
|  |                                                                                                                                                                                           |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Press the key <sil> 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.

### Organisation of the silo memory



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



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

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

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

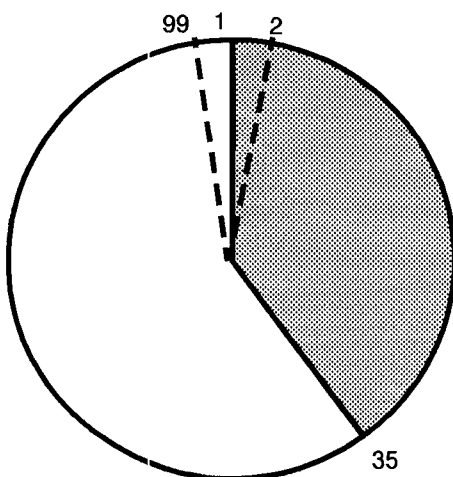
<smpl data> key with the silo memory switched on

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

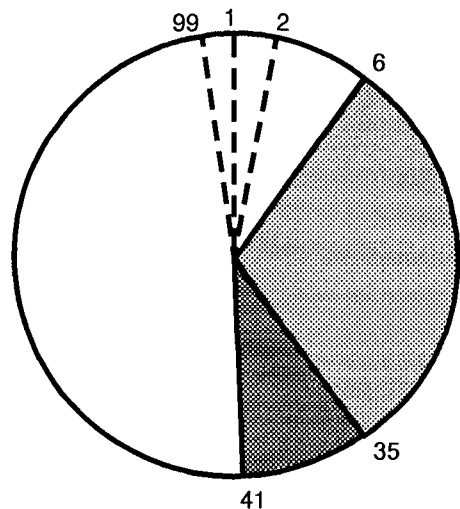
|                                  |                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>&gt;delete all silo lines</p> | <p>Delete all silo lines</p>                                                                                                                                                                                                                                                                                                                                                                             |
| <p>delete all: no</p>            | <p>Confirmation (yes, no)<br/>When all silo lines are deleted, the silo is completely empty: The line numbering starts again with 1.</p>                                                                                                                                                                                                                                                                 |
| <p>cycle lines: OFF</p>          | <p>With "ON", worked off silo lines will be copied to the highest line of the silo memory (ON, OFF)<br/>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 <u>new</u> silo lines during the determinations.</p> |
| <p>save lines: OFF</p>           | <p>Store results in the silo memory (ON, OFF)<br/>Determination results will be stored as C24 or C25 in the silo memory according to the allocations in the methods, see page 93.<br/>"save lines" can only be set to "OFF" if the silo is completely empty.</p>                                                                                                                                         |

If the silo memory is filled from the balance, a new silo line is established by transferring the weight. For mixed operation, manual input and input from a balance, the values from the balance are sent into the line in which editing just takes place. Confirmed with <enter> at the Titrimo.

**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.

## 2.16 Store determination results and silo calculations

### Store 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:

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

|                              |                                                                                                                       |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>&gt;silo calculations</b> | <b>Store determination results</b>                                                                                    |
| C24=                         | Assignment to C24 (RSX, EPX, CXX)<br>Calculated results (RSX), endpoints (EPX) or variables CXX can be stored as C24. |
| C25=                         | Same procedure for C25.                                                                                               |

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

#### 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>):

|                                 |        |          |          |          |        |             |         |
|---------------------------------|--------|----------|----------|----------|--------|-------------|---------|
| 'si                             |        |          |          |          |        |             |         |
| 736 GP Titrino OPl/101 736.0010 |        |          |          |          |        |             |         |
| date 96-01-26 time 08:54 14     |        |          |          |          |        |             |         |
| >Silo                           |        |          |          |          |        |             |         |
| cycle lines : OFF               |        |          |          |          |        |             |         |
| save lines : ON                 |        |          |          |          |        |             |         |
| sl                              | method | id 1/C21 | id 2/C22 | id 3/C23 | C00    | C24         | C25     |
| + 1                             | 11-2   | A/12     | 94-09-12 |          | 0.233g | 0.142ml/min | 98.53%  |
| + 2                             | 11-2   | A/13     | 94-09-12 |          | 0.286g | 0.138ml/min | 95.75%  |
| / 3                             | 11-2   | A/14     | 94-09-12 |          | 0.197g | 0.145ml/min | 100.61% |
| 4                               | 11-2   | A/15     | 94-09-12 |          | 0.288g | NV          | NV      |
| 5                               | 11-2   | A/16     | 94-09-12 |          | 0.263g | NV          | NV      |

Silo lines have been processed, results saved

Silo lines not yet processed

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

- + Silo line has been processed. 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.



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

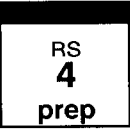

**Important:**

- 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:
  - . Calculation of the results RSX
  - . Assignment of temporary variables C7X for TIP
  - . Calculation of means MNX
  - . Assignment of silo results C24 and C25
  - . Silo calculations
  - . Assignment of means C26 and C27 from silo calculations
  - . Assignment of common variables C3X


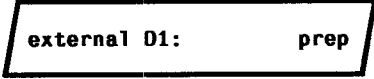

## 2.17 Preparation of the titrating burets, keys <prep> and <DOS>

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.

|                                                                                   |                                                                                   |                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | <p>&lt;prep&gt; serves as preselection for the buret: internal D0, external D1, external D2.</p> <p>With &lt;DOS&gt;, the preselected buret will dose as long as &lt;DOS&gt; is pressed. If no buret has been preselected, the buret which is active in the method, will dose.</p> |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Key <prep>

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>With &lt;START&gt;, the preparation (or emptying, resp.) of the selected buret will begin. The parameters for the preparation are under &lt;configuration&gt;, see page 9f.</p>                                                                                                                                                                                                                                                                                                                                   |
|  | <p>To change the buret, press &lt;prep&gt; repeatedly.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|  | <p><b>Internal buret D0, Titrimo buret</b></p> <p><b>External buret D1</b><br/>The Titrimo recognizes the buret type automatically (Dosimat or Dosino).<br/><i>For Dosinos:</i></p> <ul style="list-style-type: none"><li>- After the preparation the dosing unit is without air bubbles and filled up to the top of tube.</li><li>- Press &lt;select&gt; for "empty". This function empties the Dosino completely, e.g. for cleaning the dosing unit.</li></ul> <p><b>External buret D2</b><br/>as for buret D1</p> |

#### 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 <configuration>, see page 9f.

## 3. Operation via RS232 interface

### 3.1 General rules

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

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

**&Mode.Select "SET"**

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

**&M.S"SET"** .

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

**&Config**

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

**&Config.RSSet**

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

**&Config.RSSet.Baud**

or regarding the setting of the parity

**&Config.RSSet.Parity**

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

**&Config.RSSet.Baud**

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

**&Config.RSSet.Baud \$Q** Q for Query

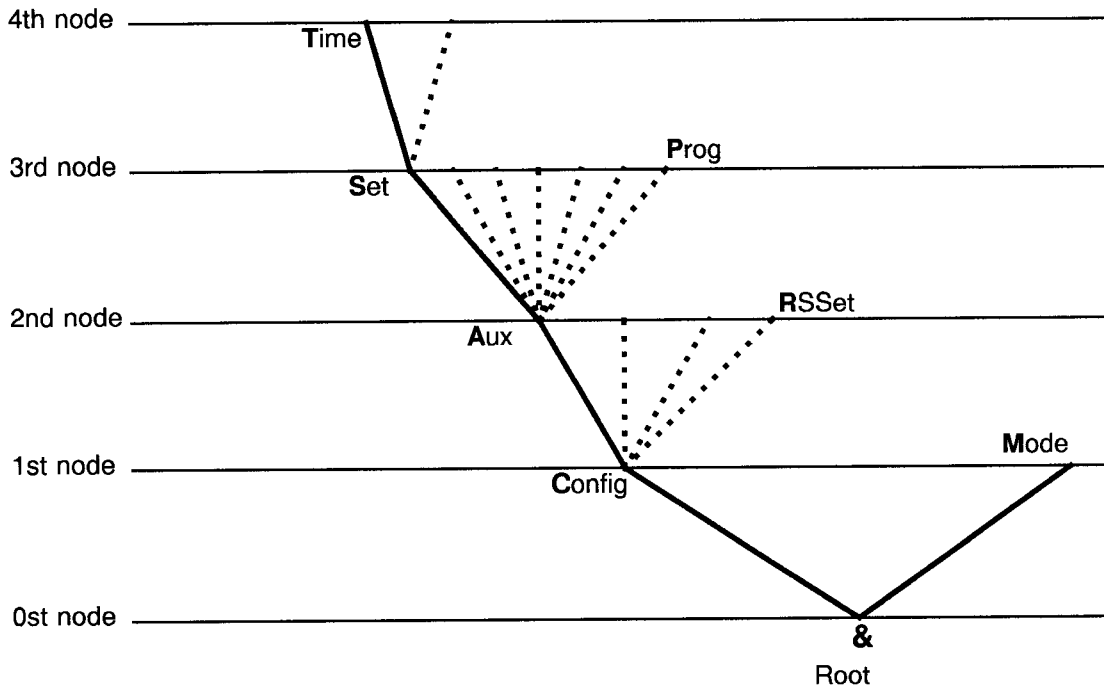
**\$Q** triggers the output of the value from the Titrino. Entries that are introduced with the character dollar (\$) trigger something. They are thus called **triggers** in what follows.

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

**&Config.RSSet.Baud "9600"**

### 3.1.1 Call up of objects

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



**Rules:**

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

**Examples:**

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

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

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

Correct entries of numbers:

**"-31.2273"**

**"0.1"**

incorrect entries:

**"1,5" or "+3" or ".1"**

Entry of a different time:  
**"08:15"**

- New objects can also be addressed relative to old objects:  
**A preceding point** moves one node **forwards** in the tree.  
**More than one preceding point** moves one node **backwards** in the tree. n nodes backwards require n + 1 preceding points.
- If a jump is to be made back to the root, a preceding & is entered.

From the root to the node 'Aux':

**&C.A**

Forwards from the node 'Aux' to 'Set': **.S**

Jump from 'Set' onto the node 'Aux' and selection of a new object at this node 'Prog': **..P**

Jump from the object 'Prog' over the node 'Aux' to the node 'Config' and to the new node 'RSSet': **...R**

Change from the node 'RSSet' via the root into the node 'Mode': **&M**

### 3.1.2 Triggers

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

The following triggers are possible:

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

The triggers \$G, \$S and \$H, \$C are linked to objects, see overview table, pages 106ff.

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

Examples:

Inquiry of the value of the baud rate: **&Config.RSSet.Baud \$Q**

Inquiry of all values of the node 'RSSet': **&Config.RSSet \$Q**

Inquiry of the path of the node 'RSSet': **&Config.RSSet \$Q.P**

Start of the current mode: **&Mode \$G**

Inquiry of the detailed status: **\$D**

### 3.1.3 Status and error messages

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

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

|     |           |                                                                                                             |
|-----|-----------|-------------------------------------------------------------------------------------------------------------|
| \$G | Go:       | The Titrino is executing the last command.                                                                  |
| \$H | Hold:     | The Titrino has been holded (\$H, key < meas/hold > or by an error which effects the hold status)           |
| \$C | Continue: | The Titrino has been restarted actively after hold                                                          |
| \$R | Ready:    | The Titrino has executed the last command and is ready                                                      |
| \$S | Stop:     | A process has been aborted in an "unnatural manner".<br>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 .ld1:  | Instrument in the DET mode, requesting ld1 after titration start.                                       |
|                  | .ld2:       | Instrument in the DET mode, requesting ld2 after titration start.                                       |
|                  | .ld3:       | Instrument in the DET mode, requesting ld3 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 .ld1:  | Instrument in the SET mode, requesting ld1 after start.                                                 |
|                  | .ld2:       | Instrument in the SET mode, requesting ld2 after start.                                                 |
|                  | .ld3:       | Instrument in the SET mode, requesting ld3 after start.                                                 |
|                  | .Smpl:      | Instrument in the SET mode, requesting sample size after start.                                         |
|                  | .Unit:      | Instrument in the SET mode, requesting unit of sample size after start.                                 |
|                  | .Start:     | Instrument in the SET mode, processing the start conditions.                                            |
|                  | .SET1:      | Instrument in the SET mode, titrating to the first end point.                                           |
|                  | .SET2:      | Instrument in the SET mode, titrating to the second end point.                                          |
|                  | .Cond.Ok:   | Instrument in the SET, conditioning, end point reached (after the first startup from the standby mode). |
|                  | .Cond.Prog: | Instrument in the SET mode, conditioning, end point not reached (Conditioning progressing).             |
| \$G .Mode.KFT... |             | As SET.                                                                                                 |
| \$G .Mode.STAT   | .Inac:      | Instrument at the beginning or at the end of a determination.                                           |
|                  | .Req .ld1:  | Instrument in the STAT mode, requesting ld1 after start.                                                |
|                  | .ld2:       | Instrument in the STAT mode, requesting ld2 after start.                                                |
|                  | .ld3:       | Instrument in the STAT mode, requesting ld3 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 buffer1.  
.Req.Buf2: Instrument in the CAL mode, requesting pH of buffer 2.  
.Meas.Buf2: Instrument in the CAL mode, measures buffer 2.  
etc.  
\$G .Assembly.Bur .Fill: Buret in filling process  
.ModeDis: Buret in Dis mode

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

\$G .TIP.X .Inac: Instrument at the beginning or 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.  
\$G .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.

**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, i.e. memory card from an other apparatus or 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  
E37 Stop Bit } devices are the same.
- E38 Overrun error. At least 1 character could not be read.  
Exit: <QUIT>
- E39 The internal receive buffer of the Titrino is full (> 82 characters).  
Exit: <QUIT>

**RS send errors:**

- E40 DSR = OFF } No proper handshake for more than 1 s.  
E41 DCD = ON } Exit: <QUIT>  
E42 CTS = OFF } Is the receiver switched on and ready to receive?
- E43 The transmission of the Titrino has been interrupted with XOFF for at least 3 s.  
Exit: Send XON or <QUIT>
- E44 The RS interface parameters are no longer the same for both devices. Reset.
- E45 The receive buffer of the Titrino contains an incomplete command (L<sub>F</sub> missing). Sending from the Titrino is therefore blocked.  
Exit: Send L<sub>F</sub> or <QUIT>.
- E120 Overrange of the primary measured value (pH, U, I<sub>pol</sub>, U<sub>pol</sub> 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 \$\$.
- 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 \$\$.
- E137: XXX Bytes are missing so that the method, the silo line could not be stored or not enough RAM for TIP.  
Exit: Send new command.
- E149: Rate missing for calculation.  
Exit: The error message disappears on next start or on recalculation.
- E150: Number of rates does not agree with the set windows or the mean rate C80 could not be calculated.  
Exit: The error message disappears on next start or on recalculation.
- E151: Fix volume missing for calculation.  
Exit: The error message disappears on next startup or on recalculation.
- E152: Measured value outside the limits.  
Exit: The error message disappears when again within the limits or &m \$\$.
- E153: Rate outside the limits.  
Exit: The error message disappears when again within the limits or &m \$\$.
- E154: Temperature outside the limits.  
Exit: The error message disappears when again within the limits or &m \$\$.
- 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 \$\$.
- E162: No ramp end set in DOC.  
Exit: The error message disappears on next start or &m \$\$.
- 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 \$\$.
- 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 \$\$.
- 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 \$\$.
- 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.Prepare 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.
- 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

| Object              | Function                                                          | Input range                                        | see...   |
|---------------------|-------------------------------------------------------------------|----------------------------------------------------|----------|
| <b>&amp;</b>        | <b>Root</b>                                                       |                                                    |          |
| <b>Mode</b>         | <b>Mode</b>                                                       | \$G, \$S, \$H, \$C                                 | 3.2.2.1  |
| .QuickMeas          | Rapid measurement in basic mode                                   | \$G, \$S                                           | 3.2.2.2  |
| .Select             | Selection of the mode                                             | DET, MET, SET, KFT, STAT, DOS, DOC, MEAS, CAL, TIP | 3.2.2.3  |
| .DETQuantity        | Measured quantity for DET                                         | pH, U, lpol, Upol                                  |          |
| .METQuantity        | Measured quantity for MET                                         | pH, U, lpol, Upol                                  |          |
| .SETQuantity        | Measured quantity for SET                                         | pH, U, lpol, Upol                                  | 3.2.2.3  |
| .MEASQuantity       | Measured quantity for MEAS                                        | pH, U, lpol, Upol, T                               | 3.2.2.3  |
| .KFTQuantity        | Measured quantity for KFT                                         | lpol, Upol                                         | 3.2.2.3  |
| .STATQuantity       | Measured quantity for STAT                                        | pH, U, lpol, Upol                                  | 3.2.2.3  |
| .DOCQuantity        | Measured quantity for DOC                                         | pH, U, lpol, Upol                                  | 3.2.2.3  |
| .Name               | Name of the current method                                        | read only/read + write                             | 3.2.2.4  |
| .Parameter*         | Parameters of current method, depend on the mode, see pages 107ff |                                                    |          |
| <b>.Def</b>         | <b>Definitions for the data output</b>                            |                                                    |          |
| .Formulas           | <b>Calculation formulae</b>                                       |                                                    |          |
| .1                  | For result 1                                                      |                                                    |          |
| .Formula            | Calculation formula                                               | special                                            | 3.2.2.5  |
| .TextRS             | Text for result specification                                     | up to 8 ASCII char                                 | 3.2.2.5  |
| .Decimal            | Decimal places                                                    | 0...5                                              | 3.2.2.5  |
| .Unit               | Unit for the result                                               | up to 8 ASCII char                                 | 3.2.2.5  |
| up to 9 results     |                                                                   |                                                    |          |
| .SiloCalc           | <b>Silo calculations</b>                                          |                                                    |          |
| .Assign             | Assignments for result storage                                    |                                                    |          |
| .C24                | As C24                                                            | RSX, EPX, CXX                                      | 3.2.2.6  |
| .C25                | As C25                                                            | RSX, EPX, CXX                                      | 3.2.2.6  |
| .MatchId            | Matching of Ids                                                   | id1, id1&2, all, OFF                               | 3.2.2.6  |
| .ComVar             | <b>Assignment of common variables</b>                             |                                                    |          |
| .C30                | Common variable C30                                               | RSX, MNX, EPX, CXX                                 | 3.2.2.7  |
| up to C39           |                                                                   |                                                    |          |
| .Report             | <b>Data output at the end of titration</b>                        |                                                    |          |
| .Assign             | Assignment                                                        | depends on mode                                    | 3.2.2.8  |
| .Mean               | <b>Assignments for statistics calculations</b>                    |                                                    |          |
| .1                  | Mean value 1, MN1                                                 |                                                    |          |
| .Assign             | Assignment for MN1                                                | RSX, EPX, CXX                                      | 3.2.2.9  |
| up to 9 assignments |                                                                   |                                                    |          |
| .TempVar            | <b>Assignment of temporary variables</b>                          |                                                    |          |
| .C70                | Common variable C70                                               | RSX, EPX, CXX                                      | 3.2.2.10 |
| up to C79           |                                                                   |                                                    |          |
| .CFmla              | <b>Calculation constants</b>                                      |                                                    |          |
| .1                  | Calculation constant C01                                          |                                                    |          |
| .Value              | Value for C01                                                     | 0... ± 999 999                                     | 3.2.2.11 |
| up to C19           |                                                                   |                                                    |          |

| Object             | Function                                   | Input range                              | see...   |
|--------------------|--------------------------------------------|------------------------------------------|----------|
| <b>*Parameter</b>  | <b>Tree part "Parameters for DET"</b>      |                                          |          |
| <b>.TitrPara</b>   | <b>Titration parameters</b>                |                                          |          |
| .MptDensity        | Measuring point density                    | 0...9                                    | 3.2.2.12 |
| .MinIncr           | Minimum Increment                          | 0...999.9                                | 3.2.2.12 |
| .DosRate           | Dispensing rate for increments             | 0.01...150.0, max.                       | 3.2.2.13 |
| .SignalDrift       | Drift for measured value acquisition       | depends on meas quant.                   | 3.2.2.14 |
| .UnitSigDrift      | Unit of the measured value drift           | read only                                | 3.2.2.14 |
| .EquTime           | Equilibr. time for meas. value acquisition | 0...9999, OFF                            | 3.2.2.14 |
| .StartV            | Start volume                               |                                          |          |
| .Type              | Type of start volume                       | abs., rel., OFF                          | 3.2.2.15 |
| .V                 | Volume for the absolute start volume       | 0...999.99                               | 3.2.2.15 |
| .Factor            | Factor for the relative start volume       | 0... ± 999 999                           | 3.2.2.15 |
| .Rate              | Dispensing rate                            | 0.01...150, max.                         | 3.2.2.15 |
| .Pause             | Waiting time                               | 0...999 999                              | 3.2.2.16 |
| .DosUnit           | Selection of the dosing unit               | internal D0, external D1,<br>external D2 | 3.2.2.17 |
| .MeasInput         | Measuring input                            | 1, 2, diff.                              | 3.2.2.18 |
| .Ipol              | Polarisation current                       | 0... ± 127                               | 3.2.2.18 |
| .Upol              | Polarisation potential                     | 0... ± 1270                              | 3.2.2.18 |
| .PolElectrTest     | Test for polarized electrodes              | ON, OFF                                  | 3.2.2.18 |
| .Temp              | Titration temperature                      | -170.0...500.0                           | 3.2.2.19 |
| <b>.StopCond</b>   | <b>Stop conditions</b>                     |                                          |          |
| .VStop             | Stop volume                                |                                          |          |
| .Type              | Type of stop volume                        | abs., rel., OFF                          | 3.2.2.20 |
| .V                 | Volume for the absolute stop volume        | 0...9999.99                              | 3.2.2.20 |
| .Factor            | Factor for the relative stop volume        | 0... ± 999 999                           | 3.2.2.20 |
| .MeasStop          | Stop measured value pH, U, I               | depends on meas quant.                   | 3.2.2.21 |
| .UnitMStop         | Unit of the stop measured value            | read only                                | 3.2.2.21 |
| .EPStop            | Stop after a number of end points          | 1...9, OFF                               | 3.2.2.22 |
| .FillRate          | Filling rate after the titration           | 0.01...150.0, max.                       | 3.2.2.23 |
| <b>.Statistics</b> | <b>Statistics calculations</b>             |                                          |          |
| .Status            | Status of the statistics                   | ON, OFF                                  | 3.2.2.24 |
| .MeanN             | Number of individual determinations        | 2...20                                   | 3.2.2.24 |
| .ResTab            | Result table                               |                                          |          |
| .Select            |                                            | original, delete n,<br>delete all        | 3.2.2.24 |
| .DelN              | Deletion of individual results             | 1...20                                   | 3.2.2.24 |
| <b>.Evaluation</b> | <b>Evaluation</b>                          |                                          | 3.2.2.25 |
| .EPC               | EP criterion                               | 0...200                                  | 3.2.2.25 |
| .Recognition       | EP recognition                             |                                          |          |
| .Select            | Type of EP recognition                     | all, greatest, last,<br>window, OFF      | 3.2.2.25 |
| .Window            | Window                                     |                                          |          |
| .1                 |                                            |                                          |          |
| .LowLim            | Lower limit window 1                       | depends on meas quant.                   | 3.2.2.25 |
| .UpLim             | Upper limit window 1                       | depends on meas quant.                   | 3.2.2.25 |
| .1                 | up to 9 windows                            |                                          |          |
| .FixEP             | Fix end points                             |                                          |          |
| .1                 | Fix EP 1                                   |                                          |          |
| .Value             | Measured value for fix EP 1                | depends on meas quant.                   | 3.2.2.25 |
| .1                 | up to 9 fix EP's                           |                                          |          |
| .pK                | pK or HNP evaluation                       | ON, OFF                                  | 3.2.2.25 |
| <b>.Presel</b>     | <b>Preselections</b>                       |                                          |          |
| .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                    | 3.2.2.26 |
| .ActPulse          | Output of a pulse                          | ON, OFF                                  | 3.2.2.27 |

| Object             | Function                                   | Input range                           | see...   |
|--------------------|--------------------------------------------|---------------------------------------|----------|
| <b>*Parameter</b>  | <b>Tree part "Parameters for MET"</b>      |                                       |          |
| <b>.TitrPara</b>   | <b>Titration parameters</b>                |                                       |          |
| .VStep             | Volume increment                           | 0...9.999                             | 3.2.2.12 |
| .DosRate           | Dispensing rate for increments             | 0.01...150.0, max.                    | 3.2.2.13 |
| .SignalDrift       | Drift for measured value acquisition       | depends on meas quant.                | 3.2.2.14 |
| .UnitSigDrift      | Unit of the measured value drift           | read only                             | 3.2.2.14 |
| .EquTime           | Equilibr. time for meas. value acquisition | 0...9999, OFF                         | 3.2.2.14 |
| .StartV            | Start volume                               |                                       |          |
| .Type              | Type of start volume                       | abs., rel., OFF                       | 3.2.2.15 |
| .V                 | Volume for the absolute start volume       | 0...999.99                            | 3.2.2.15 |
| .Factor            | Factor for the relative start volume       | 0... ± 999 999                        | 3.2.2.15 |
| .Rate              | Dispensing rate                            | 0.01...150, max.                      | 3.2.2.15 |
| .Pause             | Waiting time                               | 0...999 999                           | 3.2.2.16 |
| .DosUnit           | Selection of the dosing unit               | internal D0, external D1, external D2 | 3.2.2.17 |
| .MeasInput         | Measuring input                            | 1, 2, diff.                           | 3.2.2.18 |
| .Ipol              | Polarisation current                       | 0... ± 127                            | 3.2.2.18 |
| .Upol              | Polarisation potential                     | 0... ± 1270                           | 3.2.2.18 |
| .PolElectrTest     | Test for polarized electrodes              | ON, OFF                               | 3.2.2.18 |
| .Temp              | Titration temperature                      | -170.0...500.0                        | 3.2.2.19 |
| <b>.StopCond</b>   | <b>Stop conditions</b>                     |                                       |          |
| .VStop             | Stop volume                                |                                       |          |
| .Type              | Type of stop volume                        | abs., rel., OFF                       | 3.2.2.20 |
| .V                 | Volume for the absolute stop volume        | 0...9999.99                           | 3.2.2.20 |
| .Factor            | Factor for the relative stop volume        | 0... ± 999 999                        | 3.2.2.20 |
| .MeasStop          | Stop measured value pH, U, I               | depends on meas quant.                | 3.2.2.21 |
| .UnitMStop         | Unit of the stop measured value            | read only                             | 3.2.2.21 |
| .EPStop            | Stop after a number of end points          | 1...9, OFF                            | 3.2.2.22 |
| .FillRate          | Filling rate after the titration           | 0.01...150.0, max.                    | 3.2.2.23 |
| <b>.Statistics</b> | <b>Statistics calculations</b>             |                                       |          |
| .Status            | Status of the statistics                   | ON, OFF                               | 3.2.2.24 |
| .MeanN             | Number of individual determinations        | 2...20                                | 3.2.2.24 |
| .ResTab            | Result table                               |                                       |          |
| .Select            |                                            | original, delete n, delete all        | 3.2.2.24 |
| .DelN              | Deletion of individual results             | 1...20                                | 3.2.2.24 |
| <b>.Evaluation</b> | <b>Evaluation</b>                          |                                       | 3.2.2.25 |
| .EPC               | EP criterion                               | depends on meas quant.                | 3.2.2.25 |
| .Recognition       | EP recognition                             |                                       |          |
| .Select            | Type of EP recognition                     | all, greatest, last, window, OFF      | 3.2.2.25 |
| .Window            | Window                                     |                                       |          |
| .1                 |                                            |                                       |          |
| .LowLim            | Lower limit window 1                       | depends on meas quant.                | 3.2.2.25 |
| .UpLim             | Upper limit window 1                       | depends on meas quant.                | 3.2.2.25 |
| up to 9 windows    |                                            |                                       |          |
| .FixEP             | Fix end points                             |                                       |          |
| .1                 | Fix EP1                                    |                                       |          |
| .Value             | Measured value for fix EP1                 | depends on meas quant.                | 3.2.2.25 |
| up to 9 fix EP's   |                                            |                                       |          |
| .pK                | pK or HNP evaluation                       | ON, OFF                               | 3.2.2.25 |
| <b>.Presel</b>     | <b>Preselections</b>                       |                                       |          |
| .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                 | 3.2.2.26 |
| .ActPulse          | Output of a pulse                          | ON, OFF                               | 3.2.2.27 |

| Object                | Function                                             | Input range                              | see...   |
|-----------------------|------------------------------------------------------|------------------------------------------|----------|
| <b>*Parameter</b>     | <b>Tree part"Parameters for SET"</b>                 |                                          |          |
| <b>.SET1</b>          | <b>Control parameters for EP1</b>                    |                                          |          |
| <b>.EP</b>            | End point 1                                          | depends on meas quant.                   | 3.2.2.28 |
| <b>.UnitEp</b>        | Unit of the end point EP1                            | read only                                | 3.2.2.28 |
| <b>.Dyn</b>           | Dynamics                                             | depends on meas quant.                   | 3.2.2.29 |
| <b>.UnitDyn</b>       | Unit for dynamics                                    | read only                                | 3.2.2.29 |
| <b>.MaxRate</b>       | Maximum dosing rate                                  | 0.01...150, max.                         | 3.2.2.29 |
| <b>.MinRate</b>       | Minimum dosing rate                                  | 0.01...999.9                             | 3.2.2.29 |
| <b>.Stop</b>          | Titration stop                                       |                                          |          |
| <b>.Type</b>          | Type of stop criterion                               | drift, time                              | 3.2.2.30 |
| <b>.Drift</b>         | Stop drift                                           | 1...999                                  | 3.2.2.30 |
| <b>.Time</b>          | Switch-off delay time                                | 0...999, inf                             | 3.2.2.30 |
| <b>.StopT</b>         | Stop time                                            | 0...999 999, OFF                         | 3.2.2.30 |
| <b>.SET2</b>          | <b>Control parameters for EP2, identical to SET1</b> |                                          |          |
| <b>.TitrPara</b>      | <b>Titration parameters</b>                          |                                          |          |
| <b>.Direction</b>     | Titration direction                                  | + , -, auto                              | 3.2.2.31 |
| <b>.XPause</b>        | Waiting time before start volume                     | 0...999 999                              | 3.2.2.32 |
| <b>.StartV</b>        | Start volume                                         |                                          |          |
| <b>.Type</b>          | Type of start volume                                 | abs., rel., OFF                          | 3.2.2.15 |
| <b>.V</b>             | Volume for the absolute start volume                 | 0...999.99                               | 3.2.2.15 |
| <b>.Factor</b>        | Factor for the relative start volume                 | 0... ± 999 999                           | 3.2.2.15 |
| <b>.Rate</b>          | Dosing rate                                          | 0.01...150, max.                         | 3.2.2.15 |
| <b>.Pause</b>         | Waiting time after start volume                      | 0...999 999                              | 3.2.2.16 |
| <b>.ExtrT</b>         | Extraction time                                      | 0...999 999                              | 3.2.2.33 |
| <b>.DosUnit</b>       | Selection of dosing unit                             | internal D0, external D1,<br>external D2 | 3.2.2.17 |
| <b>.MeasInput</b>     | Measurement input                                    | 1, 2, diff.                              | 3.2.2.18 |
| <b>.Ipol</b>          | Polarization current                                 | 0... ± 127                               | 3.2.2.18 |
| <b>.Upol</b>          | Polarization voltage                                 | 0... ± 1270                              | 3.2.2.18 |
| <b>.PolElectrTest</b> | Test for polarized electrodes                        | ON, OFF                                  | 3.2.2.18 |
| <b>.Temp</b>          | Titration temperature                                | -170.0...500.0                           | 3.2.2.19 |
| <b>.StopCond</b>      | <b>Stop conditions</b>                               |                                          |          |
| <b>.VStop</b>         | Stop volume                                          |                                          |          |
| <b>.Type</b>          | Type of stop volume                                  | abs., rel., OFF                          | 3.2.2.20 |
| <b>.V</b>             | Volume for absolute stop volume                      | 0...9999.99                              | 3.2.2.20 |
| <b>.Factor</b>        | Factor for relative stop volume                      | 0... ± 999 999                           | 3.2.2.20 |
| <b>.FillRate</b>      | Filling rate after the titration                     | 0.01...150.0, max.                       | 3.2.2.23 |
| <b>.Statistics</b>    | <b>Statistics calculations</b>                       |                                          |          |
| <b>.Status</b>        | Status of the statistics                             | ON, OFF                                  | 3.2.2.24 |
| <b>.MeanN</b>         | Number of individual determinations                  | 2...20                                   | 3.2.2.24 |
| <b>.ResTab</b>        | Result table                                         |                                          |          |
| <b>.Select</b>        |                                                      | original, delete n,<br>delete all        | 3.2.2.24 |
| <b>.DelN</b>          | Deletion of individual results                       | 1...20                                   | 3.2.2.24 |
| <b>.Presel</b>        | <b>Preselections</b>                                 |                                          |          |
| <b>.Cond</b>          | Conditioning                                         | ON, OFF                                  | 3.2.2.34 |
| <b>.DriftDisp</b>     | Display of the drift during conditioning             | ON, OFF                                  | 3.2.2.34 |
| <b>.DCor</b>          | Drift correction                                     |                                          |          |
| <b>.Type</b>          | Drift type                                           | auto, man., OFF                          | 3.2.2.34 |
| <b>.Value</b>         | Value of manual drift correction                     | 0.0...99.9                               | 3.2.2.34 |
| <b>.IReq</b>          | Request of Id's after start                          | id1, id1&2, all, OFF                     | 3.2.2.26 |
| <b>.SReq</b>          | Request of sample size after start                   | value, unit, all, OFF                    | 3.2.2.26 |
| <b>.ActPulse</b>      | Pulse output                                         | first, all, cond., OFF                   | 3.2.2.27 |

| Object             | Function                             | Input range                              | see...   |
|--------------------|--------------------------------------|------------------------------------------|----------|
| <b>*Parameter</b>  | <b>Subtree "Parameters for KFT"</b>  |                                          |          |
| <b>.CtrlPara</b>   | <b>Control parameters for EP</b>     |                                          |          |
| .EP                | End point                            | depends on meas quant.                   | 3.2.2.35 |
| .UnitEp            | Unit of the end point EP             | read only                                | 3.2.2.35 |
| .Dyn               | Dynamics                             | depends on meas quant.                   | 3.2.2.36 |
| .UnitDyn           | Unit of dynamics                     | read only                                | 3.2.2.36 |
| .MaxRate           | Maximum dispensing rate              | 0.01...150, max.                         | 3.2.2.36 |
| .MinIncr           | Minimum volume increment             | 0.1...9.9, min.                          | 3.2.2.36 |
| .Stop              | Titration stop                       |                                          |          |
| .Type              | Type of stop criterion               | drift, time                              | 3.2.2.37 |
| .Drift             | Stop drift                           | 1...999                                  | 3.2.2.37 |
| .Time              | Switch-off delay time                | 0...999, INF                             | 3.2.2.37 |
| .StopT             | Stop time                            | 0...999 999, OFF                         | 3.2.2.37 |
| <b>.TitrPara</b>   | <b>Titration parameters</b>          |                                          |          |
| .Direction         | Titration direction                  | +, -, auto                               | 3.2.2.31 |
| .XPause            | Pause 1                              | 0...999 999                              | 3.2.2.32 |
| .StartV            | Start volume                         |                                          |          |
| .Type              | Type of start volume                 | abs., rel., OFF                          | 3.2.2.15 |
| .V                 | Volume for the absolute start volume | 0...999.99                               | 3.2.2.15 |
| .Factor            | Factor for the relative start volume | 0... ± 999 999                           | 3.2.2.15 |
| .Rate              | Dispensing rate                      | 0.01...150, max.                         | 3.2.2.15 |
| .Pause             | Pause 2                              | 0...999 999                              | 3.2.2.16 |
| .ExtrT             | Extraction time                      | 0...999 999                              | 3.2.2.33 |
| .DosUnit           | Selection of dosing unit             | internal D0, external D1,<br>external D2 | 3.2.2.17 |
| .MeasInput         | without meaning                      |                                          |          |
| .Ipol              | Polarization current                 | 0... ± 127                               | 3.2.2.18 |
| .Upol              | Polarization voltage                 | 0... ± 1270                              | 3.2.2.18 |
| .PolElectrTest     | Test for polarized electrodes        | ON, OFF                                  | 3.2.2.18 |
| .Temp              | Titration temperature                | -170.0...500.0                           | 3.2.2.19 |
| <b>.StopCond</b>   | <b>Stop conditions</b>               |                                          |          |
| .VStop             | Stop volume                          |                                          |          |
| .Type              | Type of stop volume                  | abs., rel., OFF                          | 3.2.2.20 |
| .V                 | Volume for the absolute stop volume  | 0...9999.99                              | 3.2.2.20 |
| .Factor            | Factor for the relative stop volume  | 0... ± 999 999                           | 3.2.2.20 |
| .FillRate          | Filling rate after the titration     | 0.01...150.0, max.                       | 3.2.2.23 |
| <b>.Statistics</b> | <b>Statistics calculations</b>       |                                          |          |
| .Status            | Status of the statistics             | ON, OFF                                  | 3.2.2.24 |
| .MeanN             | Number of individual determinations  | 2...20                                   | 3.2.2.24 |
| .ResTab            | Result table                         |                                          |          |
| .Select            |                                      | original, delete n,<br>delete all        | 3.2.2.24 |
| .DelN              | Deletion of individual results       | 1...20                                   | 3.2.2.24 |
| <b>.Presel</b>     | <b>Preselections</b>                 |                                          |          |
| .Cond              | Conditioning                         | ON, OFF                                  | 3.2.2.34 |
| .DriftDisp         | Drift display during conditioning    | ON, OFF                                  | 3.2.2.34 |
| .DCor              | Drift correction                     |                                          |          |
| .Type              | Drift type                           | auto, man., OFF                          | 3.2.2.34 |
| .Value             | Value for manual drift correction    | 0.0...99.9                               | 3.2.2.34 |
| .IReq              | Request of Id's after start          | id1, id2, all, OFF                       | 3.2.2.26 |
| .SReq              | Request of sample size after start   | value, unit, all, OFF                    | 3.2.2.26 |
| .ActPulse          | Pulse output                         | first, all, cond., OFF                   | 3.2.2.27 |

| Object             | Function                             | Input range                              | see...   |
|--------------------|--------------------------------------|------------------------------------------|----------|
| <b>*Parameter</b>  | <b>Subtree "Parameters for STAT"</b> |                                          |          |
| <b>.CtrlPara</b>   | <b>Control paramters</b>             |                                          |          |
| .EP                | Measuring point                      | depends on meas quant.                   | 3.2.2.35 |
| .UnitEp            | Unit of measuring point              | read only                                | 3.2.2.35 |
| .Dyn               | Control range                        | depends on meas quant.                   | 3.2.2.36 |
| .UnitDyn           | Unit of control range                | read only                                | 3.2.2.36 |
| .MaxRate           | Maximum dosing rate                  | 0.01...150, max.                         | 3.2.2.36 |
| .MinRate           | Minimum dosing rate                  | 0.01...999.9                             | 3.2.2.38 |
| <b>.TitrPara</b>   | <b>Titration parameter</b>           |                                          |          |
| .StartV            | Start volume                         |                                          |          |
| .Type              | Type of start volume                 | abs., rel., OFF                          | 3.2.2.15 |
| .V                 | Volume for the absolute start volume | 0...999.99                               | 3.2.2.15 |
| .Factor            | Factor for the relative start volume | 0... ± 999 999                           | 3.2.2.15 |
| .Rate              | Dosing rate                          | 0.01...150, max.                         | 3.2.2.15 |
| .Pause             | Waiting time                         | 0...999 999                              | 3.2.2.16 |
| .TStart            | Start time                           | 0...999 999                              | 3.2.2.39 |
| .StartMeas         | Start of measuring value             | depends on meas quant.                   | 3.2.2.39 |
| .RateStart         | Start rate                           | 0.01...150, OFF                          | 3.2.2.39 |
| .TDelta            | Time interval for meas point entry   | 1...999 999                              | 3.2.2.40 |
| .Direction         | Titration direction                  | +, -, auto                               | 3.2.2.31 |
| .DosUnit           | Selection of dosing unit             | internal D0, external D1,<br>external D2 | 3.2.2.17 |
| .MeasInput         | Measuring input                      | 1, 2, diff.                              | 3.2.2.18 |
| .Ipol              | Polarization current                 | 0... ± 127                               | 3.2.2.18 |
| .Upol              | Polarization voltage                 | 0... ± 1270                              | 3.2.2.18 |
| .PolElectrTest     | Test for polarized electrodes        | ON, OFF                                  | 3.2.2.18 |
| .Temp              | Temperature                          | -170.0...500.0                           | 3.2.2.19 |
| <b>.StopCond</b>   | <b>Stop conditions</b>               |                                          |          |
| .TStop             | Stop after time                      |                                          |          |
| .Type              | Type of stop time                    | abs., rel., delta,<br>delay, OFF         | 3.2.2.41 |
| .Time              | Time for the absolute stop time      | 0...999 999                              | 3.2.2.41 |
| .Factor            | Factor for the relative stop time    | 0... ± 999 999                           | 3.2.2.41 |
| .Delta             | Time after EP is once reached        | 0...999 999                              | 3.2.2.41 |
| .Delay             | Time after last dosing step          | 0...999 999                              | 3.2.2.41 |
| .VStop             | Stop volume                          |                                          |          |
| .Type              | Type of stop volume                  | abs., rel., OFF                          | 3.2.2.20 |
| .V                 | Volume for the absolute stop volume  | 0...9999.99                              | 3.2.2.20 |
| .Factor            | Factor for the relative stop volume  | 0... ± 999 999                           | 3.2.2.20 |
| .RateStop          | Stop rate                            | 0.01...150, OFF                          | 3.2.2.42 |
| .FillRate          | Filling rate after titration         | 0.01...150.0, max.                       | 3.2.2.23 |
| <b>.Statistics</b> | <b>Statistics calculation</b>        |                                          |          |
| .Status            | Status of statistics calculation     | ON, OFF                                  | 3.2.2.24 |
| .MeanN             | Number n of single values            | 2...20                                   | 3.2.2.24 |
| .ResTab            | Result table                         |                                          |          |
| .Select            |                                      | original, delete n,<br>delete all        | 3.2.2.24 |
| .DelN              | Delete single results                | 1...20                                   | 3.2.2.24 |

| Object               | Function                                          | Input range                   | see...   |
|----------------------|---------------------------------------------------|-------------------------------|----------|
| <b>*Parameter</b>    | <b>Subtree"Parameters for STAT", continuation</b> |                               |          |
| <b>.Evaluation</b>   | <b>Evaluation</b>                                 |                               |          |
| <b>.TimeWin</b>      | Time windows for rates evaluation                 |                               |          |
| <b>.1</b>            | Window 1                                          |                               |          |
| <b>.LowLim</b>       | Lower limit                                       | 0...999 999, OFF              | 3.2.2.43 |
| <b>.UpLim</b>        | upper limit                                       | 0...999 999, OFF              | 3.2.2.43 |
| <b>.1</b>            | up to 9 windows                                   |                               |          |
| <b>.FixVol</b>       | Fix volume                                        |                               |          |
| <b>.1</b>            | 1st fix volume                                    |                               |          |
| <b>.Value</b>        | Value                                             | 0...999 999, OFF              | 3.2.2.44 |
| <b>.1</b>            | up to 9 fix volumes                               |                               |          |
| <b>.FixTime</b>      | Fix times                                         |                               |          |
| <b>.1</b>            | 1st fix time                                      |                               |          |
| <b>.Value</b>        | Value                                             | 0.01...1, OFF                 | 3.2.2.45 |
| <b>.1</b>            | up to 9 fix times                                 |                               |          |
| <b>.Monitoring</b>   | <b>Monotoring</b>                                 |                               |          |
| <b>.MeasVal</b>      | Monotoring of measuring values                    |                               |          |
| <b>.Status</b>       | Status                                            | ON, OFF                       | 3.2.2.46 |
| <b>.LowLim</b>       | Lower limit                                       | depends on meas quant.        | 3.2.2.46 |
| <b>.UpLim</b>        | Upper limit                                       | depends on meas quant.        | 3.2.2.46 |
| <b>.Action</b>       | Action, if out-off limits                         | end, hold, wait, none         | 3.2.2.46 |
| <b>.Rate</b>         | Monotoring of rates                               |                               |          |
| <b>.Status</b>       | Status                                            | ON, OFF                       | 3.2.2.47 |
| <b>.LowLim</b>       | Lower limit                                       | 0.000...150                   | 3.2.2.47 |
| <b>.UpLim</b>        | Upper limit                                       | 0.000...150                   | 3.2.2.47 |
| <b>.Action</b>       | Action, if out-off limits                         | end, hold, wait, none         | 3.2.2.47 |
| <b>.Temp</b>         | Monotoring of temperature                         |                               |          |
| <b>.Status</b>       | Status                                            | ON, OFF                       | 3.2.2.48 |
| <b>.LowLim</b>       | Lower limit                                       | -170.0...500.0                | 3.2.2.48 |
| <b>.UpLim</b>        | Upper limit                                       | -170.0...500.0                | 3.2.2.48 |
| <b>.Action</b>       | Action, if out-off limits                         | end, hold, wait, none         | 3.2.2.48 |
| <b>.AssignOutput</b> | Assignment of output L4, Pin 3                    | meas, temp, rate, all<br>none | 3.2.2.49 |
| <b>.Output</b>       | Type of signal                                    | active, pulse                 | 3.2.2.49 |
| <b>.Preselel</b>     | <b>Preselections</b>                              |                               |          |
| <b>.IReq</b>         | Request of identifications after start            | id1, id1&2, all, OFF          | 3.2.2.26 |
| <b>.SReq</b>         | Request of sample size after start                | value, unit, all, OFF         | 3.2.2.26 |
| <b>.RateDisp</b>     | Rate display                                      | ON, OFF                       | 3.2.2.50 |
| <b>.ActPulse</b>     | Pulse output                                      | ON, OFF                       | 3.2.2.27 |

| Object             | Function                            | Input range                              | see...   |
|--------------------|-------------------------------------|------------------------------------------|----------|
| <b>*Parameter</b>  | <b>Subtree "Parameters for DOS"</b> |                                          |          |
| <b>.DosPara</b>    | <b>Dosing parameters</b>            |                                          |          |
| .Type              | Type of dosing                      | volume, time, rate                       | 3.2.2.51 |
| .Volume            | Dosing after volume                 |                                          |          |
| .Volume            | Volume                              | 0.000...99999.99                         | 3.2.2.51 |
| .DisType           | 2nd dosing criterion                | time, rate                               | 3.2.2.51 |
| .Rate              | Rate                                | 0.001...150, max.                        | 3.2.2.51 |
| .Time              | Dosing time                         | 1...999 999                              | 3.2.2.51 |
| .Time              | Dosing after time                   |                                          |          |
| .Time              | Dosing time                         | 1...999 999                              | 3.2.2.51 |
| .DisType           | 2nd dosing criterion                | volume, rate                             | 3.2.2.51 |
| .Rate              | Rate                                | 0.001...150, max.                        | 3.2.2.51 |
| .Volume            | Dosing volume                       | 0.000...99999.99                         | 3.2.2.51 |
| .Rate              | Dosing after rate                   |                                          |          |
| .Rate              | Rate                                | 0.001...150, max.                        | 3.2.2.51 |
| .StopType          | Stop criterion                      | time, volume                             | 3.2.2.51 |
| .Time              | Dosing time                         | 1...999 999                              | 3.2.2.51 |
| .Volume            | Dosing volume                       | 0.000...99999.99                         | 3.2.2.51 |
| .Pause             | Waiting time                        | 0...999 999                              | 3.2.2.52 |
| .TDelta            | Time interval for measuring input   | 1...999 999                              | 3.2.2.53 |
| .DosUnit           | Selection of dosing unit            | internal D0, external D1,<br>external D2 | 3.2.2.17 |
| .Temp              | Titration temperature               | -170.0...500.0                           | 3.2.2.54 |
| <b>.StopCond</b>   | <b>Stop conditions</b>              |                                          |          |
| .VStop             | Stop volume                         |                                          |          |
| .Type              | Type of stop volume                 | abs., rel., OFF                          | 3.2.2.20 |
| .V                 | Volume for absolute stop volume     | 0...99 999.99                            | 3.2.2.20 |
| .Factor            | Factor for relative stop volume     | 0... ± 999 999                           | 3.2.2.20 |
| .FillRate          | Filling rate after titration        | 0.01...150.0, max.                       | 3.2.2.23 |
| <b>.Statistics</b> | <b>Statistics calculation</b>       |                                          |          |
| .Status            | Status of statistics calculation    | ON, OFF                                  | 3.2.2.24 |
| .MeanN             | Number n of single values           | 2...20                                   | 3.2.2.24 |
| .ResTab            | Result table                        |                                          |          |
| .Select            |                                     | original, delete n,<br>delete all        | 3.2.2.24 |
| .DelN              | Delete single results               | 1...20                                   | 3.2.2.24 |
| <b>.Monitoring</b> | <b>Monitoring</b>                   |                                          |          |
| .MeasVal           | Monitoring of measuring value       |                                          |          |
| .MeasMode          | Measuring value                     | pH, U, Ipol, Upol, OFF                   | 3.2.2.55 |
| .MeasInput         | Measuring input                     | 1, 2, diff.                              | 3.2.2.55 |
| .PCurrent          | Polarization current                | 0... ± 127                               | 3.2.2.55 |
| .PVoltage          | Polarization voltage                | 0... ± 1270                              | 3.2.2.55 |
| .PolElectrTest     | Test for polarized electrodes       | ON, OFF                                  | 3.2.2.55 |
| .pH                | Limits for monitoring pH value      |                                          |          |
| .LowLim            | Lower limit                         | 0... ± 20.00                             | 3.2.2.55 |
| .UpLim             | Upper limit                         | 0... ± 20.00                             | 3.2.2.55 |
| .U                 | Limits for monitoring voltage       |                                          |          |
| .LowLim            | Lower limit                         | 0... ± 2000                              | 3.2.2.55 |
| .UpLim             | Upper limit                         | 0... ± 2000                              | 3.2.2.55 |
| .Ipol              | Limits for monitoring voltage       |                                          |          |
| .LowLim            | Lower limit                         | 0... ± 2000                              | 3.2.2.55 |
| .UpLim             | Upper limit                         | 0... ± 2000                              | 3.2.2.55 |
| .Upol              | Limits for monitoring current       |                                          |          |
| .LowLim            | Lower limit                         | 0... ± 200.0                             | 3.2.2.55 |
| .UpLim             | Upper limit                         | 0... ± 200.0                             | 3.2.2.55 |
| .Action            | Action, if out-off limits           | end, hold, wait, none                    | 3.2.2.55 |

| Object               | Function                                                      | Input range           | see...   |
|----------------------|---------------------------------------------------------------|-----------------------|----------|
| <b>*Parameter</b>    | <b>Subtree "Parameters for DOS, Monitoring", continuation</b> |                       |          |
| <b>.Monitoring</b>   | <b>Monitoring</b>                                             |                       |          |
| <b>.Temp</b>         | Monitoring of the temperatur                                  |                       |          |
| <b>.Status</b>       | Status                                                        | ON, OFF               | 3.2.2.48 |
| <b>.LowLim</b>       | Lower limit                                                   | -170.0...500.0        | 3.2.2.48 |
| <b>.UpLim</b>        | Upper limit                                                   | -170.0...500.0        | 3.2.2.48 |
| <b>.Action</b>       | Action, if out-off limits                                     | end, hold, wait, none | 3.2.2.48 |
| <b>.AssignOutput</b> | Assignment of output L4 (pin 3)                               | meas, temp, all, none | 3.2.2.49 |
| <b>.Output</b>       | Type of signal                                                | active, pulse         | 3.2.2.49 |
| <b>.Presel</b>       | <b>Preselection</b>                                           |                       |          |
| <b>.IReq</b>         | Request of identifications after start                        | id1, id1&2, all, OFF  | 3.2.2.26 |
| <b>.SReq</b>         | Request of sample size after start                            | value, unit, all, OFF | 3.2.2.26 |
| <b>.ActPulse</b>     | Pulse output                                                  | ON, OFF               | 3.2.2.27 |

| Object             | Function                               | Input range                              | see...   |
|--------------------|----------------------------------------|------------------------------------------|----------|
| <b>*Parameter</b>  | <b>Subtree "Parameters for DOC"</b>    |                                          |          |
| <b>.DosPara</b>    | <b>Dosing parameter</b>                |                                          |          |
| .BeginMeas         | Begin of measuring                     | depends on meas quant.                   | 3.2.2.56 |
| .EndMeas           | End of measuring                       | depends on meas quant.                   | 3.2.2.56 |
| .UnitMeas          | Unit of measuring quantity             | read only                                | 3.2.2.56 |
| .SweepTime         | Sweep time                             | 0...999 999                              | 3.2.2.57 |
| .Dyn               | Dynamics                               | depends on meas quant.                   | 3.2.2.58 |
| .UnitDyn           | Unit of dynamics                       | read only                                | 3.2.2.58 |
| .MaxRate           | Maximum rate                           | 0.01...150, max.                         | 3.2.2.58 |
| .MinRate           | Minimum rate                           | 0.01...999.9                             | 3.2.2.58 |
| .Direction         | Titration direction                    | + , - , auto                             | 3.2.2.59 |
| .StartV            | Start volume                           |                                          |          |
| .Type              | Type of start volume                   | abs., rel., OFF                          | 3.2.2.60 |
| .V                 | Volume for absolute start volume       | 0...999.99                               | 3.2.2.60 |
| .Factor            | Factor for relative start volume       | 0... ± 999 999                           | 3.2.2.60 |
| .Rate              | Dosing rate                            | 0.01...150, max.                         | 3.2.2.60 |
| .Pause             | Waiting time                           | 0...999 999                              | 3.2.2.60 |
| .TDelta            | Time interval for measuring input      | 1...999 999                              | 3.2.2.53 |
| .DosUnit           | Selection of dosing unit               | internal D0, external D1,<br>external D2 | 3.2.2.17 |
| .MeasInput         | Measuring input                        | 1, 2, diff.                              | 3.2.2.61 |
| .Ipol              | Polarization current                   | 0... ± 127                               | 3.2.2.61 |
| .Upol              | Polarization voltage                   | 0... ± 1270                              | 3.2.2.61 |
| .PolElectrTest     | Test for polarized electrodes          | ON, OFF                                  | 3.2.2.61 |
| .Temp              | Temperature                            | -170.0...500.0                           | 3.2.2.54 |
| <b>.StopCond</b>   | <b>Stop conditions</b>                 |                                          |          |
| .VStop             | Stop volume                            |                                          |          |
| .Type              | Type of stop volume                    | abs., rel., OFF                          | 3.2.2.20 |
| .V                 | Volume for the absolute stop volume    | 0...9999.99                              | 3.2.2.20 |
| .Factor            | Factor for the relative stop volume    | 0... ± 999 999                           | 3.2.2.20 |
| .FillRate          | Filling rate after titration           | 0.01...150.0, max.                       | 3.2.2.23 |
| <b>.Statistics</b> | <b>Statistics calculation</b>          |                                          |          |
| .Status            | Status of statistics calculation       | ON, OFF                                  | 3.2.2.24 |
| .MeanN             | Number n of single values              | 2...20                                   | 3.2.2.24 |
| .ResTab            | Result table                           |                                          |          |
| .Select            |                                        | original, delete n,<br>delete all        | 3.2.2.24 |
| .DelN              | Delete single results                  | 1...20                                   | 3.2.2.24 |
| <b>.Monitoring</b> | <b>Monitoring</b>                      |                                          |          |
| .MeasVal           | Monitoring of measuring value          |                                          |          |
| .Status            | Status                                 | ON, OFF                                  | 3.2.2.46 |
| .LowLim            | Lower limit                            | depends on meas quant.                   | 3.2.2.46 |
| .UpLim             | Upper limit                            | depends on meas quant.                   | 3.2.2.46 |
| .Action            | Action, if out-off limits              | end, hold, wait, none                    | 3.2.2.46 |
| .Temp              | Temperature                            |                                          |          |
| .Status            | Status                                 | ON, OFF                                  | 3.2.2.48 |
| .LowLim            | Lower limit                            | -170.0...500.0                           | 3.2.2.48 |
| .UpLim             | Upper limit                            | -170.0...500.0                           | 3.2.2.48 |
| .Action            | Action, if out-off limits              | end, hold, wait, none                    | 3.2.2.48 |
| .AssignOutput      | Assignment of output L4 (pin 3)        | meas, temp, all, none                    | 3.2.2.49 |
| .Output            | Type of signal                         | active, pulse                            | 3.2.2.49 |
| <b>.Presele</b>    | <b>Preselections</b>                   |                                          |          |
| .IReq              | Request of identifications after start | id1, id1&2, all, OFF                     | 3.2.2.26 |
| .SReq              | Request of sample size after start     | value, unit, all, OFF                    | 3.2.2.26 |
| .RateDisp          | Rate display                           | ON, OFF                                  | 3.2.2.50 |
| .ActPulse          | Pulse output                           | ON, OFF                                  | 3.2.2.27 |

| Object             | Function                               | Input range                       | see...   |
|--------------------|----------------------------------------|-----------------------------------|----------|
| <b>*Parameter</b>  | <b>Subtree "Parameters for MEAS"</b>   |                                   |          |
| <b>.Measuring</b>  | <b>Measuring parameter</b>             |                                   |          |
| .SignalDrift       | Signal drift                           | depends on meas quant.            | 3.2.2.62 |
| .UnitSigDrift      | Unit for signal drift                  | read only                         | 3.2.2.62 |
| .EquTime           | Waiting time for signal drift          | 0...9999, OFF                     | 3.2.2.62 |
| .MeasInput         | Measuring input                        | 1, 2, diff.                       | 3.2.2.62 |
| .Ipol              | Polarization current                   | 0... ± 127                        | 3.2.2.63 |
| .Upol              | Polarization voltage                   | 0... ± 1270                       | 3.2.2.63 |
| .PolElectrTest     | Test for polarized electrodes          | ON, OFF                           | 3.2.2.63 |
| .Temp              | Temperature                            | -170.0...500.0                    | 3.2.2.64 |
| <b>.Statistics</b> | <b>Statistics calculation</b>          |                                   |          |
| .Status            | Status of statistics calculation       | ON, OFF                           | 3.2.2.24 |
| .MeanN             | Number n of single values              | 2...20                            | 3.2.2.24 |
| .ResTab            | Result table                           |                                   |          |
| .Select            |                                        | original, delete n,<br>delete all | 3.2.2.24 |
| .DelN              | Delete single results                  | 1...20                            | 3.2.2.24 |
| <b>.Presel</b>     | <b>Preselections</b>                   |                                   |          |
| .IReq              | Request of identifications after start | id1, id1&2, all, OFF              | 3.2.2.26 |
| .SReq              | Request of sample size after start     | value, unit, all, OFF             | 3.2.2.26 |
| .ActPulse          | Pulse output                           | ON, OFF                           | 3.2.2.27 |

|                     |                                     |                                   |          |
|---------------------|-------------------------------------|-----------------------------------|----------|
| <b>*Parameter</b>   | <b>Subtree "Parameters for CAL"</b> |                                   |          |
| <b>.Calibration</b> | <b>Calibration parameters</b>       |                                   |          |
| .MeasInput          | Measuring input                     | 1, 2, diff.                       | 3.2.2.65 |
| .CalTemp            | Calibration temperature             | -20.0...120.0                     | 3.2.2.66 |
| .Buffer             |                                     | buffer pH value<br>buffer 1       |          |
| .1                  |                                     |                                   |          |
| .Value              | pH value of buffer 1                | 0... ± 20.00                      | 3.2.2.67 |
| .2                  |                                     | buffer 2                          |          |
| .Value              | pH value of buffer 2                | 0... ± 20.00, OFF                 | 3.2.2.67 |
| .SignalDrift        | Signal drift                        | 0.5...999, OFF                    | 3.2.2.68 |
| .EquTime            | Waiting time after signal drift     | 0...9999, OFF                     | 3.2.2.68 |
| .Electrodeld        | Identification of electrodes        | 8 ASCII characters                | 3.2.2.69 |
| .SmpIChanger        | Calibration at sample changer       | ON, OFF                           | 3.2.2.70 |
| .ActPulse           | Pulse output                        | first, all, OFF                   | 3.2.2.71 |
| <b>.Statistics</b>  | <b>Statistics calculation</b>       |                                   |          |
| .Status             | Status statistics calculation       | ON, OFF                           | 3.2.2.24 |
| .MeanN              | Number n of single values           | 2...20                            | 3.2.2.24 |
| .ResTab             | Result table                        |                                   |          |
| .Select             |                                     | original, delete n,<br>delete all | 3.2.2.24 |
| .DelN               | Delete single results               | 1...20                            | 3.2.2.24 |

| Object                | Function                                   | Input range                                            | see...   |
|-----------------------|--------------------------------------------|--------------------------------------------------------|----------|
| <b>*Parameter</b>     | <b>Subtree "Parameters for TIP"</b>        |                                                        |          |
| <b>.Sequence</b>      | <b>Sequence</b>                            |                                                        |          |
| .1                    | 1st step                                   |                                                        |          |
| <b>.Select</b>        | Selection of step                          | method, pause, L4 output<br>L6 output, info, prep, OFF | 3.2.2.72 |
| <b>.Method</b>        | Method from the working memory             | special                                                | 3.2.2.73 |
| <b>.Pause</b>         | Waiting time                               | 0...999 999, INF                                       | 3.2.2.73 |
| <b>.L4Output</b>      | Line L4                                    | active,inactive,pulse,OFF                              | 3.2.2.73 |
| <b>.L6Output</b>      | Line L6                                    | active,inactive,pulse,OFF                              | 3.2.2.73 |
| <b>.Info</b>          | Display information                        | up to 16 ASCII characters                              | 3.2.2.73 |
| <b>.Prep</b>          | Preparation of titrating buret             | internal D0, external D1,<br>external D2               | 3.2.2.73 |
|                       | up to 30 steps                             |                                                        |          |
| <b>.Statistics</b>    | <b>Statistics calculation</b>              |                                                        |          |
| <b>.Status</b>        | Status of statistics calculation           | ON, OFF                                                | 3.2.2.24 |
| <b>.MeanN</b>         | Number n of single values                  | 2...20                                                 | 3.2.2.24 |
| <b>.ResTab</b>        | Result table                               |                                                        |          |
| <b>.Select</b>        |                                            | original, delete n,<br>delete all                      | 3.2.2.24 |
| <b>.DelN</b>          | Delete single results                      | 1...20                                                 | 3.2.2.24 |
| <b>.Presel</b>        | <b>Preselection</b>                        |                                                        |          |
| <b>.IReq</b>          | Request of identification after start      | id1, id1&2, all, OFF                                   | 3.2.2.26 |
| <b>.SReq</b>          | Request of sample size after start         | value, unit, all, OFF                                  | 3.2.2.26 |
| <b>.MeasMode</b>      | Measuring mode for manual measuring        | pH, U, Ipol, Upol, T, OFF                              | 3.2.2.74 |
| <b>.MeasInput</b>     | Measuring input                            | 1, 2, diff.                                            | 3.2.2.74 |
| <b>.Ipol</b>          | Polarization currents                      | 0... ± 127                                             | 3.2.2.74 |
| <b>.UPol</b>          | Polarization voltage                       | 0... ± 1270                                            | 3.2.2.74 |
| <b>.PolElectrTest</b> | Test for polarized electrodes              | ON, OFF                                                | 3.2.2.74 |
| <b>.Temp</b>          | Temperature                                | -170.0...500.0                                         | 3.2.2.74 |
| <b>&amp;</b>          | <b>Root</b>                                |                                                        |          |
| <b>UserMeth</b>       | <b>Administration of the memory method</b> |                                                        |          |
| <b>.FreeMem</b>       | Free memory                                | read only                                              | 3.2.2.75 |
| <b>.Recall</b>        | Recall method                              | \$G                                                    | 3.2.2.76 |
| <b>.Name</b>          | Method name                                | up to 8 ASCII characters                               | 3.2.2.76 |
| <b>.Store</b>         | Store memory                               | \$G                                                    | 3.2.2.76 |
| <b>.Name</b>          | Method name                                | up to 8 ASCII characters                               | 3.2.2.76 |
| <b>.Delete</b>        | Delete memory                              | \$G                                                    | 3.2.2.76 |
| <b>.Name</b>          | Method name                                | up to 8 ASCII characters                               | 3.2.2.76 |
| <b>.DelAll</b>        | Delete all methods                         | \$G                                                    | 3.2.2.76 |
| <b>.List</b>          | List of methods in the memory              |                                                        |          |
| .1                    | Method 1                                   |                                                        |          |
| <b>.Name</b>          | Method name                                | read only                                              | 3.2.2.77 |
| <b>.Mode</b>          | Mode                                       | read only                                              | 3.2.2.77 |
| <b>.Quantity</b>      | Quantity                                   | read only                                              | 3.2.2.77 |
| <b>.DosUnit</b>       | Dosing element                             | read only                                              | 3.2.2.77 |
| <b>.Bytes</b>         | Number of used bytes in the method         | read only                                              | 3.2.2.77 |
| <b>.Checksum</b>      | Checksum of method<br>for each method      | read only                                              | 3.2.2.77 |

| Object            | Function                                 | Input range               | see...   |
|-------------------|------------------------------------------|---------------------------|----------|
| <b>&amp;</b>      | <b>Root</b>                              |                           |          |
| <b>MemoryCard</b> | <b>Administration of the memory card</b> |                           |          |
| .Recall           | Recall method                            | \$G                       | 3.2.2.78 |
| .Name             | Method name                              | up to 8 ASCII characters  | 3.2.2.78 |
| .Store            | Store method                             | \$G                       | 3.2.2.78 |
| .Name             | Method name                              | up to 8 ASCII characters  | 3.2.2.78 |
| .Delete           | Delete method                            | \$G                       | 3.2.2.78 |
| .Name             | Method name                              | up to 8 ASCII characters  | 3.2.2.78 |
| .ChangeDir        | Change directory                         | \$G                       | 3.2.2.79 |
| .Name             | Directory name                           | up to 10 ASCII characters | 3.2.2.79 |
| .Checksum         | Calculate checksum of directory          | \$G                       | 3.2.2.79 |
| .Value            | Value of checksum                        | read only                 | 3.2.2.79 |
| .CreateDir        | Create new directory                     | \$G                       | 3.2.2.80 |
| .Name             | Directory name                           | up to 10 ASCII characters | 3.2.2.80 |
| .DelDir           | Delete directory                         | \$G                       | 3.2.2.81 |
| .Name             | Directory name                           | up to 10 ASCII characters | 3.2.2.81 |
| .Backup           | Backup of internal memory                | \$G                       | 3.2.2.82 |
| .Name             | Directory name                           | up to 10 ASCII characters | 3.2.2.82 |
| .Reload           | Reload backup from the card              | \$G                       | 3.2.2.83 |
| .Name             | Directory name                           | up to 10 ASCII characters | 3.2.2.83 |
| .Format           | Format the card                          | \$G                       | 3.2.2.84 |
| .CardLabel        |                                          |                           |          |
| .Name             | Card label                               | up to 8 ASCII characters  | 3.2.2.84 |
| .FreeMem          | Free memory on the card                  | read only                 | 3.2.2.85 |
| .BatteryChange    | Date for battery change                  | \$G                       | 3.2.2.86 |
| .Date             | Date                                     | YYYY-MM-DD                | 3.2.2.86 |
| .List             | Lists                                    |                           |          |
| .Card             | Directories on the card                  |                           |          |
| .1                |                                          |                           |          |
| .Name             | Directory name                           | read only                 | 3.2.2.87 |
| .Bytes            | Bytes used by the directory              | read only                 | 3.2.2.87 |
|                   | for each directory                       |                           |          |
| .ActDir           | Method in the current directory          |                           |          |
| .1                | Method 1                                 |                           |          |
| .Name             | Method name                              | read only                 | 3.2.2.88 |
| .Mode             | Mode                                     | read only                 | 3.2.2.88 |
| .Quantity         | Measuring quantity                       | read only                 | 3.2.2.88 |
| .DosUnit          | Dosing element                           | read only                 | 3.2.2.88 |
| .Bytes            | Number of used bytes in the method       | read only                 | 3.2.2.88 |
| .Checksum         | Checksum of method                       | read only                 | 3.2.2.88 |
|                   | for each method                          |                           |          |

|               |                                        |                                                                       |          |
|---------------|----------------------------------------|-----------------------------------------------------------------------|----------|
| <b>&amp;</b>  | <b>Root</b>                            |                                                                       |          |
| <b>Config</b> | <b>Configuration</b>                   |                                                                       |          |
| .PeriphUnit   | <b>Selection of peripheral unit</b>    |                                                                       |          |
| .CharSet      | Selection of character set             | Epson,Seiko,Citizen,<br>IBM,HP                                        | 3.2.2.89 |
| .Balance      | Selection of balance                   | Sartorius,Mettler,Mett-<br>ler AT, AND,Precisa                        | 3.2.2.90 |
| .Plot         | Selection of plot at analog output     | U,dU/dt,V,dV/dt,U(rel),T                                              | 3.2.2.90 |
| .Aux          | <b>Adjusting different auxiliaries</b> |                                                                       |          |
| .Language     | Selection of dialog language           | english,deutsch,français,<br>espanol,portuguese,<br>italiano, svenska | 3.2.2.91 |
| .Set          | Setting of date and time               | \$G                                                                   | 3.2.2.92 |
| .Date         | Date                                   | XXXX-XX-XX                                                            | 3.2.2.92 |
| .Time         | Time                                   | XX:XX                                                                 | 3.2.2.92 |
| .RunNo        | Run number                             | 0...9999                                                              | 3.2.2.93 |
| .AutoStart    | Internal automatic start               | 1...9999, OFF                                                         | 3.2.2.94 |
| .StartDelay   | Start delay                            | 0...999 999                                                           | 3.2.2.95 |
| .DevName      | Device label                           | 8 ASCII Char                                                          | 3.2.2.96 |
| .Prog         | Program version                        | read only                                                             | 3.2.2.97 |

| Object        | Function                                        | Input range                              | see...    |
|---------------|-------------------------------------------------|------------------------------------------|-----------|
| &             | <b>Root</b>                                     |                                          |           |
|               | <b>Configuration, continuation</b>              |                                          |           |
|               | <b>RS232 settings</b>                           |                                          |           |
| .RSSet        |                                                 | \$G                                      | 3.2.2.98  |
| .Baud         | Baud rate                                       | special (300...9600)                     | 3.2.2.99  |
| .DataBit      | Data bit                                        | 7,8                                      | 3.2.2.99  |
| .StopBit      | Stop bit                                        | 1,2                                      | 3.2.2.99  |
| .Parity       | Parity                                          | even,odd,none                            | 3.2.2.99  |
| .Handsh       | Handshake                                       | HWs,HWf,SWchar,<br>SWline,none           | 3.2.2.99  |
| .ComVar       | <b>Values of common variables</b>               |                                          |           |
| .C30          | Values from C30<br>up to C39                    | 0... ± 999 999                           | 3.2.2.100 |
| .DosPrep      | <b>Parameters for the preparation of burets</b> |                                          |           |
| .PowerOnPrep  | Warning after power on                          | ON, OFF                                  | 3.2.2.101 |
| .Report       | Preparation report                              | ON, OFF                                  | 3.2.2.102 |
| .Select       | Selection of dosing unit                        | internal D0, external D1,<br>external D2 | 3.2.2.103 |
| .D0           | Internal Titrino buret                          |                                          |           |
| .WarnInterval | Warning interval for preparation                | 5...9999, OFF                            | 3.2.2.104 |
| .V            | Volume                                          | 0...99999.99                             | 3.2.2.105 |
| .Repeat       | Number of cycles                                | 1...9                                    | 3.2.2.106 |
| .DosRate      | Dosing rate                                     | 0.01...150, max.                         | 3.2.2.107 |
| .FillRate     | Filling rate                                    | 0.01...150, max.                         | 3.2.2.107 |
| .D1           | Buret D1                                        |                                          |           |
| .WarnInterval | Warning interval for preparation                | 5...9999, OFF                            | 3.2.2.104 |
| .Select       | Type of dosing unit                             | Dosimat, Dosino                          | 3.2.2.108 |
| .Dosimat      | Parameters for Dosimats                         |                                          |           |
| .V            | Volume                                          | 0...99999.99                             | 3.2.2.105 |
| .Repeat       | Number of cycles                                | 1...9                                    | 3.2.2.106 |
| .DosRate      | Dosing rate                                     | 0.01...150, max.                         | 3.2.2.107 |
| .FillRate     | Filling rate                                    | 0.01...150, max.                         | 3.2.2.107 |
| .Dosino       | Parameters for Dosinos                          |                                          |           |
| .Outlet       | Expelling outlet                                | tip, flask                               | 3.2.2.109 |
| .DosTubing    | Size of dosing tube                             |                                          |           |
| .Length       | Length                                          | 1...999.9                                | 3.2.2.110 |
| .Diameter     | Diameter                                        | 0.1...9.9                                | 3.2.2.110 |
| .AspirTubing  | Size of aspiration tube                         |                                          |           |
| .Length       | Length                                          | 1...999.9                                | 3.2.2.110 |
| .Diameter     | Diameter                                        | 0.1...9.9                                | 3.2.2.110 |
| .DosRate      | Dosing rate                                     | 0.01...150, max.                         | 3.2.2.111 |
| .FillRate     | Filling rate                                    | 0.01...150, max.                         | 3.2.2.111 |
| .D2           | Buret D2 as for D1                              |                                          |           |

| Object             | Function                               | Input range              | see...    |
|--------------------|----------------------------------------|--------------------------|-----------|
| <b>&amp;</b>       | <b>Root</b>                            |                          |           |
| <b>SmplData</b>    | <b>Sample datas</b>                    |                          |           |
| <b>.Status</b>     | Status of silo memory                  | ON, OFF                  | 3.2.2.112 |
| <b>.OFFSilo</b>    | Current sample datas (Silo = OFF)      |                          |           |
| <b>.Id1</b>        | Sample identification 1                | up to 8 ASCII characters | 3.2.2.113 |
| <b>.Id2</b>        | Sample identification 2                | up to 8 ASCII characters | 3.2.2.113 |
| <b>.Id3</b>        | Sample identification 3                |                          | 3.2.2.113 |
| <b>.ValSmpl</b>    | Sample size                            | ± X.XXXXX                | 3.2.2.113 |
| <b>.UnitSmpl</b>   | Unit of sample size                    | up to 5 ASCII characters | 3.2.2.113 |
| <b>.ONSilo</b>     | Sample data of silo memory (Silo = ON) |                          |           |
| <b>.Counter</b>    | Counter of silo memory                 |                          |           |
| <b>.MaxLines</b>   | Maximum lines                          | read only                | 3.2.2.114 |
| <b>.FirstLine</b>  | First line                             | read only                | 3.2.2.114 |
| <b>.LastLine</b>   | Last line                              | read only                | 3.2.2.114 |
| <b>.EditLine</b>   | Editing silo lines                     |                          |           |
| <b>.1</b>          | 1st silo line                          |                          |           |
| <b>.Method</b>     | Method, which is used with sample      |                          | 3.2.2.115 |
| <b>.Id1</b>        | Sample identification 1                | up to 8 ASCII characters | 3.2.2.115 |
| <b>.Id2</b>        | Sample identification 2                | up to 8 ASCII characters | 3.2.2.115 |
| <b>.Id3</b>        | Sample identification 3                | up to 8 ASCII characters | 3.2.2.115 |
| <b>.ValSmpl</b>    | Sample size                            | ± X.XXXXX                | 3.2.2.115 |
| <b>.UnitSmpl</b>   | Unity of sample size                   | up to 5 ASCII characters | 3.2.2.115 |
| <b>.C24</b>        | Variable C24                           | read only                | 3.2.2.115 |
| <b>.C25</b>        | Variable C25                           | read only                | 3.2.2.115 |
| <b>.Mark</b>       | Mark                                   | read only                | 3.2.2.115 |
|                    | up to max. 99 lines                    |                          |           |
| <b>.DelLine</b>    | Delete silo line                       | \$G                      | 3.2.2.116 |
| <b>.LineNum</b>    | Line number                            | 1...99, OFF              | 3.2.2.116 |
| <b>.DelAll</b>     | Delete all silo memory                 | \$G                      | 3.2.2.117 |
| <b>.CycleLines</b> | Cycle lines                            | ON, OFF                  | 3.2.2.118 |
| <b>.SaveLines</b>  | Store results                          | ON, OFF                  | 3.2.2.119 |

| Object                  | Function                                 | Input range                                                                                                                                                                                                          | see...    |
|-------------------------|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>&amp;</b>            | <b>Root</b>                              |                                                                                                                                                                                                                      |           |
| Info                    | <b>Information</b>                       |                                                                                                                                                                                                                      |           |
| <b>.Report</b>          | <b>Transmission of formatted reports</b> | \$G                                                                                                                                                                                                                  | 3.2.2.120 |
| <b>.Select</b>          | Selection of reports                     | configuration, parameters, smpl data, statistics, silo, calib, C-fmla, def, user method, full, short, mplist, curve, derive, comb, meas crv, temp crv, scalc full, scalc srt, prep, calc, act dir, mem card, all, ff | 3.2.2.120 |
| <b>.CalibrationData</b> | <b>pH calibration data</b>               | \$G                                                                                                                                                                                                                  | 3.2.2.121 |
| <b>.Inp1</b>            | For measuring input 1                    |                                                                                                                                                                                                                      |           |
| <b>.pHas</b>            | Asymmetrie pH                            | 0... ± 20.00                                                                                                                                                                                                         | 3.2.2.121 |
| <b>.Slope</b>           | Slope of the electrode                   | 0... ± 9.999                                                                                                                                                                                                         | 3.2.2.121 |
| <b>.Temp</b>            | Temperature                              | -170.0...500.0                                                                                                                                                                                                       | 3.2.2.121 |
| <b>.Date</b>            | Date of calibration                      | read only                                                                                                                                                                                                            | 3.2.2.121 |
| <b>.ElectrodeId</b>     | Id of the calibrated electrode           | read only                                                                                                                                                                                                            | 3.2.2.121 |
| <b>.Inp2</b>            | For measuring input 2, identical to 1    |                                                                                                                                                                                                                      |           |
| <b>.Diff</b>            | For differential input, identical to 1   |                                                                                                                                                                                                                      |           |
| <b>.PrepData</b>        | <b>Preparation data</b>                  |                                                                                                                                                                                                                      |           |
| <b>.D0</b>              | Data of the internal Titrino buret       |                                                                                                                                                                                                                      |           |
| <b>.Date</b>            | Preparation date                         | read only                                                                                                                                                                                                            | 3.2.2.122 |
| <b>.Time</b>            | Preparation time                         | read only                                                                                                                                                                                                            | 3.2.2.122 |
| <b>.D1</b>              | Data of buret D1                         |                                                                                                                                                                                                                      |           |
| <b>.Type</b>            | Buret type                               | read only                                                                                                                                                                                                            | 3.2.2.122 |
| <b>.Date</b>            | Preparation date                         | read only                                                                                                                                                                                                            | 3.2.2.122 |
| <b>.Time</b>            | Preparation time                         | read only                                                                                                                                                                                                            | 3.2.2.122 |
| <b>.D2</b>              | Datas of buret D2 as for D1              |                                                                                                                                                                                                                      |           |
| <b>.Checksums</b>       | <b>Checksums</b>                         | \$G                                                                                                                                                                                                                  | 3.2.2.123 |
| <b>.MPList</b>          | Checksum of measuring point list         | read only                                                                                                                                                                                                            | 3.2.2.123 |
| <b>.ActualMethod</b>    | Checksum of actual method                | read only                                                                                                                                                                                                            | 3.2.2.123 |
| <b>.DetermData</b>      | <b>Determination data</b>                | \$G                                                                                                                                                                                                                  | 3.2.2.124 |
| <b>.Write</b>           | Read/Write for "read only/read + write"  | ON, OFF                                                                                                                                                                                                              | 3.2.2.124 |
| <b>.ExV</b>             | Volume of exchange unit                  | read only/read + write                                                                                                                                                                                               | 3.2.2.124 |
| <b>.MPList</b>          | Measuring point list                     |                                                                                                                                                                                                                      |           |
| <b>.1</b>               | Messpunkt 1                              |                                                                                                                                                                                                                      |           |
| <b>.Attribute</b>       | Attribute                                | read only/read + write                                                                                                                                                                                               | 3.2.2.124 |
| <b>.X</b>               | X coordinate                             | read only/read + write                                                                                                                                                                                               | 3.2.2.124 |
| <b>.Y</b>               | Y coordinate                             | read only/read + write                                                                                                                                                                                               | 3.2.2.124 |
| <b>.Z1</b>              | Z1 coordinate                            | read only/read + write                                                                                                                                                                                               | 3.2.2.124 |
| <b>.Z2</b>              | Z2 coordinate                            | read only/read + write                                                                                                                                                                                               | 3.2.2.124 |
|                         | for each measuring value                 |                                                                                                                                                                                                                      |           |

| Object                | Function                                 | Input range            | see...    |
|-----------------------|------------------------------------------|------------------------|-----------|
| <b>&amp;</b>          | <b>Root</b>                              |                        |           |
| <b>Info</b>           | <b>Information, continuation</b>         |                        |           |
| <b>.TitrResults</b>   | <b>Determination results</b>             |                        |           |
| <b>.RS</b>            | Calculated results                       |                        |           |
| <b>.1</b>             | Result 1                                 |                        |           |
| <b>.Value</b>         | Result value 1                           | read only              | 3.2.2.125 |
| up to 9 results       |                                          |                        |           |
| <b>.EP</b>            | End point                                |                        |           |
| <b>.1</b>             | End point 1                              |                        |           |
| <b>.V</b>             | Volume coordinate                        | read only              | 3.2.2.125 |
| <b>.Meas</b>          | Measuring value coordinate               | read only              | 3.2.2.125 |
| <b>.Mark</b>          | Mark with more than 1EP each window      | read only              | 3.2.2.125 |
| up to 9 end points    |                                          |                        |           |
| <b>.Var</b>           | Variable C4X                             |                        |           |
| <b>.C40</b>           | Start measuring value                    | read only/read + write | 3.2.2.125 |
| <b>.C41</b>           | Titration end volume                     | read only/read + write | 3.2.2.125 |
| <b>.C42</b>           | Titration time                           | read only/read + write | 3.2.2.125 |
| <b>.C43</b>           | Volume drift                             | read only/read + write | 3.2.2.125 |
| <b>.C44</b>           | Titration temperature                    | read only/read + write | 3.2.2.125 |
| <b>.C45</b>           | Start volume                             | read only/read + write | 3.2.2.125 |
| <b>.C46</b>           | Asymmetrie pH                            | read only              | 3.2.2.125 |
| <b>.C47</b>           | Slope of the electrode                   | read only              | 3.2.2.125 |
| <b>.DTime</b>         | Time for drift correction or dosing time | read only/read + write | 3.2.2.125 |
| <b>.FixEP</b>         | Fix EP or fix volume                     |                        |           |
| <b>.51</b>            | Fix EP or fix volume                     |                        |           |
| <b>.Value</b>         | Value                                    | read only              | 3.2.2.126 |
| up to C59             |                                          |                        |           |
| <b>.pK</b>            | pK/HNP or fix times                      |                        |           |
| <b>.61</b>            | up to C69                                |                        |           |
| <b>.Value</b>         | Value                                    | read only              | 3.2.2.126 |
| <b>.TempVar</b>       | Temporary variables                      |                        |           |
| <b>.C70</b>           | up to C79                                | read only/read + write | 3.2.2.126 |
| <b>.TimeWin</b>       | Rates for time windows                   |                        |           |
| <b>.81</b>            | up to C89                                |                        |           |
| <b>.Mean</b>          | Rate                                     | read only              | 3.2.2.127 |
| <b>.Dev</b>           | Standard deviation of the rate           | read only              | 3.2.2.127 |
| <b>.MeanRateC80</b>   | Mean rate C80                            |                        |           |
| <b>.Mean</b>          | Rate                                     | read only              | 3.2.2.127 |
| <b>.Dev</b>           | Standard deviation of the rate           | read only              | 3.2.2.127 |
| <b>.StatisticsVal</b> | <b>Statistics values</b>                 |                        |           |
| <b>.ActN</b>          | Number of results in the statistic chart | read only              | 3.2.2.128 |
| <b>.1</b>             | Datas of MN1                             |                        |           |
| <b>.Mean</b>          | Mean value                               | read only              | 3.2.2.128 |
| <b>.Std</b>           | Absolute standard deviation              | read only              | 3.2.2.128 |
| <b>.RelStd</b>        | Relative standard deviation              | read only              | 3.2.2.128 |
| up to 9 mean values   |                                          |                        |           |
| <b>.SiloCalc</b>      | <b>Values of silo calculations</b>       |                        |           |
| <b>.C24</b>           | Values of C24                            |                        |           |
| <b>.Name</b>          | Name                                     | read only              | 3.2.2.129 |
| <b>.Value</b>         | Value                                    | read only              | 3.2.2.129 |
| <b>.Unit</b>          | Unit                                     | read only              | 3.2.2.129 |
| <b>.C25</b>           | as C24                                   |                        |           |
| <b>.C26</b>           | Values of C26                            |                        |           |
| <b>.ActN</b>          | Number of single values                  | read only              | 3.2.2.129 |
| <b>.Mean</b>          | Mean value                               | read only              | 3.2.2.129 |
| <b>.Std</b>           | Absolute standard deviation              | read only              | 3.2.2.129 |
| <b>.RelStd</b>        | Relative standard deviation              | read only              | 3.2.2.129 |
| <b>.C27</b>           | as C26                                   |                        |           |

| Object       | Function                                      | Input range         | see...    |
|--------------|-----------------------------------------------|---------------------|-----------|
| <b>&amp;</b> | <b>Root</b>                                   |                     |           |
|              | <b>Information, TitrResults, continuation</b> |                     |           |
|              | <b>Actual information</b>                     |                     |           |
| .ActualInfo  | I/O inputs                                    |                     |           |
| .Inputs      | Line status                                   | read only           | 3.2.2.130 |
| .Status      | Change of line status                         | read only           | 3.2.2.130 |
| .Change      | Clears the change byte                        | \$G                 | 3.2.2.130 |
| .Clear       | I/O outputs                                   |                     |           |
| .Outputs     | as inputs                                     |                     |           |
| .Assembly    | From assembly                                 |                     |           |
| .CyclNo      | Cycle number                                  | read only           | 3.2.2.131 |
| .Counter     | Assembly counter                              |                     |           |
| .V           | Volume counter                                | read only           | 3.2.2.132 |
| .Clear       | Clears above counter                          | \$G                 | 3.2.2.132 |
| .Meas        | Measuring value                               | read only           | 3.2.2.133 |
| .Titrator    | From titrator                                 |                     |           |
| .CyclNo      | Cycle number                                  | read only           | 3.2.2.134 |
| .V           | Volume                                        | read only           | 3.2.2.134 |
| .Meas        | Measuring value                               | read only           | 3.2.2.134 |
| .dVdt        | Volume drift dV/dt                            | read only           | 3.2.2.134 |
| .dMeasdt     | Measuring value drift                         | read only           | 3.2.2.134 |
| .dMeasdV     | 1st titration courve deviation                | read only           | 3.2.2.134 |
| .ERC         | ERC from DET                                  | read only           | 3.2.2.134 |
| .T           | Temperature as derivative meas value          | read only           | 3.2.2.134 |
| .MeasPt      | Entry of measuring point list                 |                     |           |
| .Index       | Index entry                                   | read only           | 3.2.2.135 |
| .X           | X coordinate                                  | read only           | 3.2.2.135 |
| .Y           | Y coordinate                                  | read only           | 3.2.2.135 |
| .Z1          | Z1 coordinate                                 | read only           | 3.2.2.135 |
| .Z2          | Z2 coordinate                                 | read only           | 3.2.2.135 |
| .EP          | EP entry                                      |                     |           |
| .Index       | Index entry                                   | read only           | 3.2.2.135 |
| .X           | X coordinate (volume)                         | read only           | 3.2.2.135 |
| .Y           | Y coordinate (measuring value)                | read only           | 3.2.2.135 |
| .Display     | Display                                       |                     |           |
| .L1          | 1st line                                      | 24 ASCII characters | 3.2.2.136 |
| .L2          | 2nd line                                      | 24 ASCII characters | 3.2.2.136 |
| .Assembly    | <b>Assembly</b>                               |                     |           |
| .CycleTime   | Cylce time                                    | read only           | 3.2.2.137 |
| .ExV         | Volume of the exchange unit                   | read only           | 3.2.2.137 |

| Object              | Function                                 | Input range                              | see...    |
|---------------------|------------------------------------------|------------------------------------------|-----------|
| <b>&amp;</b>        | <b>Root</b>                              |                                          |           |
| <b>Assembly</b>     | <b>Basic elements of the assembly</b>    |                                          |           |
| <b>.Bur</b>         | <b>Buret</b>                             |                                          |           |
| <b>.Select</b>      | Selection of the buret                   | internal D0, external D1,<br>external D2 | 3.2.2.138 |
| <b>.Empty</b>       | Emptying of the dosing unit              | \$G, \$S, \$H, \$C                       | 3.2.2.139 |
| <b>.Prep</b>        | Preparation of titrating burets          | \$G, \$S, \$H, \$C                       | 3.2.2.140 |
| <b>.Rates</b>       | Rates                                    |                                          |           |
| <b>.Forward</b>     | "Expel" in direction                     |                                          |           |
| <b>.Select</b>      | Type of rate monitoring                  | digital, analog                          | 3.2.2.141 |
| <b>.Digital</b>     | Digitale rate                            | 0...150,max.                             | 3.2.2.141 |
| <b>.Reverse</b>     | "Aspirate" in direction                  |                                          |           |
| <b>.Select</b>      | Type of rate monitoring                  | digital, analog                          | 3.2.2.141 |
| <b>.Digital</b>     | Digitale rate                            | 0...150,max.                             | 3.2.2.141 |
| <b>.Fill</b>        | Filling                                  | \$G, \$H, \$C                            | 3.2.2.142 |
| <b>.ModeDis</b>     | Dispensing mode                          | \$G, \$S, \$H, \$C                       | 3.2.2.143 |
| <b>.Select</b>      | Type of dispensing monitoring            | volume, time                             | 3.2.2.143 |
| <b>.V</b>           | Dispensing volume                        | 0.0001...9999                            | 3.2.2.143 |
| <b>.Time</b>        | Dispensing time                          | 0.25...86400                             | 3.2.2.143 |
| <b>.VStop</b>       | Limit volume                             | 0.0001...9999,OFF                        | 3.2.2.143 |
| <b>.AutoFill</b>    | Filling after every increment            | ON, OFF                                  | 3.2.2.143 |
| <b>.Meas</b>        | <b>Measuring</b>                         |                                          |           |
| <b>.Status</b>      | Measuring ON/OFF                         | ON, OFF                                  | 3.2.2.144 |
| <b>.MeasInput</b>   | Selection of measuring input             | 1, 2, Diff., lpol, Upol,<br>Temp         | 3.2.2.144 |
| <b>.lpol</b>        | Polarization current                     | 0... ± 127                               | 3.2.2.144 |
| <b>.Upol</b>        | Polarization voltage                     | 0... ± 1270                              | 3.2.2.144 |
| <b>.Outputs</b>     | <b>I/O outputs</b>                       |                                          |           |
| <b>.AutoEOD</b>     | End Of Determination pulse output        | ON, OFF                                  | 3.2.2.145 |
| <b>.SetLines</b>    | Setting of I/O outputs                   | \$G                                      | 3.2.2.145 |
| <b>.L1</b>          | Line 1 signal                            | active, inactive, pulse,<br>OFF          | 3.2.2.145 |
|                     | up to L3                                 |                                          |           |
| <b>.ResetLines</b>  | Resetting of I/O outputs                 | \$G                                      | 3.2.2.145 |
| <b>Setup</b>        | <b>Setup of operational mode</b>         |                                          |           |
| <b>.Keycode</b>     | Transmission of keycode for pressed keys | ON,OFF                                   | 3.2.2.146 |
| <b>.Tree</b>        | Response definition for \$Q              |                                          |           |
| <b>.Short</b>       | Transmission of used characters only     | ON,OFF                                   | 3.2.2.147 |
| <b>.ChangedOnly</b> | Traces only with changed values          | ON,OFF                                   | 3.2.2.147 |
| <b>.Trace</b>       | Information if values change             | ON,OFF                                   | 3.2.2.148 |
| <b>.Lock</b>        | <b>Lock key functions</b>                |                                          |           |
| <b>.Keyboard</b>    | Lock keyboard of the Titrimo             | ON,OFF                                   | 3.2.2.149 |
| <b>.Config</b>      | Lock <configuration> key                 | ON,OFF                                   | 3.2.2.149 |
| <b>.Parameter</b>   | Lock <parameters> key                    | ON,OFF                                   | 3.2.2.149 |
| <b>.SmplData</b>    | Lock <smpl data> key                     | ON,OFF                                   | 3.2.2.149 |
| <b>.UserMeth</b>    | Lock functions in <user meth>            |                                          |           |
| <b>.Recall</b>      | Lock "load"                              | ON,OFF                                   | 3.2.2.149 |
| <b>.Store</b>       | Lock "store"                             | ON,OFF                                   | 3.2.2.149 |
| <b>.Delete</b>      | Lock "delete"                            | ON,OFF                                   | 3.2.2.149 |
| <b>.Display</b>     | Lock display service of the Titrimo      | ON,OFF                                   | 3.2.2.149 |

| Object<br>&      | Function<br>Root                             | Input<br>range                                      | see...    |
|------------------|----------------------------------------------|-----------------------------------------------------|-----------|
|                  | <b>Setup of operation mode, continuation</b> |                                                     |           |
| <b>.Mode</b>     | <b>Mode sequence</b>                         |                                                     |           |
| .StartWait       | Stop point after start                       | ON, OFF                                             | 3.2.2.150 |
| .FinWait         | Stop point after run                         | ON, OFF                                             | 3.2.2.150 |
| <b>.SendMeas</b> | <b>Auto transmission ov measuring datas</b>  |                                                     |           |
| .SendStatus      | Connect/disconnect of sending                | ON,OFF                                              | 3.2.2.151 |
| .Interval        | Time interval of sending                     | 0.08...16200, MPList                                | 3.2.2.151 |
| .Select          | Selection                                    | Assembly, Titrator                                  | 3.2.2.152 |
| .Assembly        | "Assembly" values                            |                                                     |           |
| .CyclNo          | Cycle number                                 | ON,OFF                                              | 3.2.2.153 |
| .V               | Volume                                       | ON,OFF                                              | 3.2.2.153 |
| .Meas            | Measuring value belonging to cycle nu.       | ON,OFF                                              | 3.2.2.153 |
| .Titrator        | Titrator value                               |                                                     |           |
| .CyclNo          | Cycle number                                 | ON,OFF                                              | 3.2.2.154 |
| .V               | Auxiliary volume                             | ON,OFF                                              | 3.2.2.154 |
| .Meas            | Auxiliary measuring value                    | ON,OFF                                              | 3.2.2.154 |
| .dVdt            | Auxiliary volume drift                       | ON,OFF                                              | 3.2.2.154 |
| .dMeasdt         | Auxiliary measuring value drift              | ON,OFF                                              | 3.2.2.154 |
| .dMeasdV         | Auxiliary 1st deviation titration courve     | ON,OFF                                              | 3.2.2.154 |
| .ERC             | ERC in DET                                   | ON,OFF                                              | 3.2.2.154 |
| .T               | Temperature as auxiliary meas value          | ON,OFF                                              | 3.2.2.154 |
| <b>.AutoInfo</b> | <b>Auto Information with changes</b>         |                                                     |           |
| .Status          | ON/OFF with all entered information          | ON,OFF                                              | 3.2.2.155 |
| .P               | If power on                                  | ON,OFF                                              | 3.2.2.155 |
| .T               | From titrator                                |                                                     |           |
| .R               | If device status "ready"                     | ON,OFF                                              | 3.2.2.155 |
| .G               | If device is started                         | ON,OFF                                              | 3.2.2.155 |
| .GC              | Reception of start command                   | ON,OFF                                              | 3.2.2.155 |
| .S               | If device status "stop"                      | ON,OFF                                              | 3.2.2.155 |
| .B               | Start of real titration                      | ON,OFF                                              | 3.2.2.155 |
| .F               | End of determination                         | ON,OFF                                              | 3.2.2.155 |
| .E               | If error information                         | ON,OFF                                              | 3.2.2.155 |
| .H               | If device status "hold"                      | ON,OFF                                              | 3.2.2.155 |
| .C               | Continuation after hold                      | ON,OFF                                              | 3.2.2.155 |
| .O               | Conditioning OK                              | ON,OFF                                              | 3.2.2.155 |
| .N               | Conditioning not OK.                         | ON,OFF                                              | 3.2.2.155 |
| .Re              | If request after titration start             | ON,OFF                                              | 3.2.2.155 |
| .Si              | If empty silo memory                         | ON,OFF                                              | 3.2.2.155 |
| .M               | Succeed entry of meas point list             | ON,OFF                                              | 3.2.2.155 |
| .EP              | Succeed entry in EP list                     | ON,OFF                                              | 3.2.2.155 |
| .RC              | Recalculation of results                     | ON,OFF                                              | 3.2.2.155 |
| .I               | Changing a I/O input                         | ON,OFF                                              | 3.2.2.155 |
| .O               | Changing a I/O output                        | ON,OFF                                              | 3.2.2.155 |
| <b>.Graphics</b> | <b>Changing an output courve</b>             |                                                     |           |
| .Grid            | Grid over courve                             | ON,OFF                                              | 3.2.2.156 |
| .Frame           | Frame around courve                          | ON,OFF                                              | 3.2.2.156 |
| .Scale           | Type of meas value axis scale                | Full, Auto                                          | 3.2.2.156 |
| .Recorder        |                                              |                                                     |           |
| .Right           | Lenght of meas value axis                    | 0.2...1.00                                          | 3.2.2.156 |
| .Feed            | Length of volume axis                        | 0.01...1.00                                         | 3.2.2.156 |
| .PowerOn         | Simulation "power on"                        | \$G                                                 | 3.2.2.157 |
| .Initialise      | Entring value of Default                     | \$G                                                 | 3.2.2.158 |
| .Select          | Selection                                    | ActMeth,Silo,Calib,<br>Setup, Config, Assembly, All | 3.2.2.158 |
| <b>.RamInit</b>  | Initialising, see page 143                   | \$G                                                 | 3.2.2.159 |
| <b>.InstrNo</b>  | Entring device identification                | \$G                                                 | 3.2.2.160 |
| .Value           | Input of device identification               | 8 ASCII characters                                  | 3.2.2.160 |

## 3.2.2 Description of the remote control commands

3.2.2.1 **Mode** \$G, \$\$, \$H, \$C

Start and stop (\$G, \$\$) 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 3.2.2.66 and 3.2.2.67).

3.2.2.2 **Mode.QuickMeas** \$G, \$\$

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 3.2.2.74 and 3.2.2.55.  
With an ongoing measurement, the current mode can be started. This stops the measurement automatically.

|         |                          |                                                           |
|---------|--------------------------|-----------------------------------------------------------|
| 3.2.2.3 | <b>Mode.Select</b>       | <b>DET, MET, SET, KFT, STAT, DOS, DOC, MEAS, CAL, TIP</b> |
|         | <b>Mode.DETQuantity</b>  | <b>pH, U, lpol, Upol</b>                                  |
|         | <b>Mode.METQuantity</b>  | <b>pH, U, lpol, Upol</b>                                  |
|         | <b>Mode.SETQuantity</b>  | <b>pH, U, lpol, Upol</b>                                  |
|         | <b>Mode.MEASQuantity</b> | <b>pH, U, lpol, Upol, T</b>                               |
|         | <b>Mode.KFTQuantity</b>  | <b>lpol, Upol</b>                                         |
|         | <b>Mode.STATQuantity</b> | <b>pH, U, lpol, Upol</b>                                  |
|         | <b>Mode.DOCQuantity</b>  | <b>pH, U, lpol, Upol</b>                                  |

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 **Mode.Name** 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 3.2.2.124.

|         |                                    |                                        |
|---------|------------------------------------|----------------------------------------|
| 3.2.2.5 | <b>Mode.Def.Formulas.1.Formula</b> | <b>EPX, CXX, RSX, +, -, *, /, (, )</b> |
|         | <b>Mode.Def.Formulas.1.TextRS</b>  | <b>up to 8 ASCII characters</b>        |
|         | <b>Mode.Def.Formulas.1.Decimal</b> | <b>0...2...5</b>                       |
|         | <b>Mode.Def.Formulas.1.Unit</b>    | <b>up to 6 ASCII characters</b>        |
|         | <b>Mode.Def.Formulas.2.Formula</b> |                                        |
|         | 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.

|         |                                     |                                 |
|---------|-------------------------------------|---------------------------------|
| 3.2.2.6 | <b>Mode.Def.SiloCalc.Assign.C24</b> | <b>RSX, EPX, CXX</b>            |
|         | <b>Mode.Def.SiloCalc.Assign.C25</b> | <b>RSX, EPX, CXX</b>            |
|         | <b>Mode.Def.SiloCalc.MatchId</b>    | <b>id1, id1&amp;2, all, OFF</b> |

.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 **Mode.Def.ComVar.C30** RSX, MNX, EPX, CXX  
**Mode.Def.ComVar.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 3.2.2.100.

3.2.2.8 **Mode.Def.Report.Assign**  
 DET: full, short, mplist, curve, derive comb, scalc full, scalc srt, calc, param, calib, ff  
 MET: full, short, mplist, curve, scalc full, scalc srt, calc, param, calib, ff  
 SET, MEAS, CAL: full, short, scalc full, scalc srt, calc, param, calib, ff  
 STAT, DOC: full, short, mplist, curve, meas crv, temp crv, scalc full, scalc srt, calc, param, calib, ff  
 DOS: full, short, mplist, curve, meas crv, temp crv, scalc full, scalc srt, calc, param, ff  
 TIP, KFT: full, short, scalc full, scalc srt, calc, param, ff

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

3.2.2.9 **Mode.Def.Mean.1.Assign** RS1,RSX, EPX, CXX  
**Mode.Def.Mean.2.Assign**  
 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 76.

3.2.2.10 **Mode.Def.TempVar.C70** RSX, EPX, CXX  
 usw. bis **.C79**

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

3.2.2.11 **Mode.CFmla**  
**Mode.CFmla.1.Value** 0... ± 999 999  
**Mode.CFmla.2.Value**  
 etc, up to **.19**

Calculation constants specific to a method. Stored in the method memory of the Titrimo. Operands specific to the sample (3.2.2.113 and 3.2.2.125) and values of common variables (3.2.2.100) on the other hand are not stored with the methods.

3.2.2.12 **Mode.Parameter.TitrPara.MptDensity** 0...4...9  
**Mode.Parameter.TitrPara.MinIncr** 0...10.0...999.9  
**Mode.Parameter.TitrPara.VStep** 0...0.10...9.999

.MptDensity: Parameters for DET: Measuring point density.  
 .MinIncr: Parameters for DET: Minimum increment in uL. If the minimum increment is set to 0, measured values are stored vs. time.  
 .VStep: Parameters 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 **Mode.Parameter.TitrPara.DosRate** 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 **Mode.Parameter.TitrPara.SignalDrift** pH, U, Ipol: 0.5...**50**...999, OFF  
Upol: 0.05...**50**...99.9, OFF  
**Mode.Parameter.TitrPara.UnitSigDrift** read only  
**Mode.Parameter.TitrPara.EquTime** 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  $\mu\text{A}/\text{min}$  (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 18. After it has been edited once, it remains in force with the set value.

3.2.2.15 **Mode.Parameter.TitrPara.StartV.Type** abs., rel., **OFF**  
**Mode.Parameter.TitrPara.StartV.V** 0...999.99  
**Mode.Parameter.TitrPara.StartV.Factor** 0...  $\pm$  999 999  
**Mode.Parameter.TitrPara.StartV.Rate** 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:

$$\text{Start volume in mL} = \text{smpl size} * \text{factor}$$

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 **Mode.Parameter.TitrPara.Pause** 0...999 999

Parameters for DET, MET, SET, KFT, STAT: Pause time in s. Expires after the dispensing of the start volume.

3.2.2.17 **Mode.Parameter.TitrPara.DosUnit** **internal D0**, external D1/D2  
**Mode.Parameter.DosPara.DosUnit** **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 **Mode.Parameter.TitrPara.MeasInput** 1, 2, diff.  
**Mode.Parameter.TitrPara.Ipol** -127...1... + 127  
**Mode.Parameter.TitrPara.Upol** -1270...**400**... + 1270  
**Mode.Parameter.TitrPara.PolElectrTest** 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 187.

With Ipol, the inquiries for the polarisation current in  $\mu\text{A}$  (Ipol) and .PolElectrTest are valid.

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

Besides .PolElectrTest is valid.

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

3.2.2.19 **Mode.Parameter.TitrPara.Temp** -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 after the start of a method and the parameter .Temp is updated. With STAT the temperature will be measured and updated continuously, if a T sensor is connected. The temperature is used for the temperature correction in pH measurements.

3.2.2.20 **Mode.Parameter.StopCond.VStop.Type** **abs., rel., OFF**  
**Mode.Parameter.StopCond.VStop.V** **0...99.99...9999.99**  
**Mode.Parameter.StopCond.VStop.Factor** **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...99 999.99.)

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

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

$$\text{Stop volume in mL} = \text{smpl size} * \text{factor}$$

The factor is valid.

OFF means that the criterion is not monitored.

3.2.2.21 **Mode.Parameter.StopCond.MeasStop** pH: **0... ± 20.00, OFF**  
U: **0... ± 2000, OFF**  
I: **0...200.0, OFF**  
**Mode.Parameter.StopCond.UnitMStop** 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  $\mu\text{A}$  (with Upol). The appropriate unit can be viewed with .UnitMStop.

OFF means that the criterion is not monitored.

3.2.2.22 **Mode.Parameter.StopCond.EPStop** **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 **Mode.Parameter.StopCond.FillRate** **0.01...150, max.**

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

3.2.2.24 **Mode.Parameter.Statistics.Status** **ON, OFF**  
**Mode.Parameter.Statistics.MeanN** **2...20**  
**Mode.Parameter.Statistics.ResTab.Selected** **original, delete n, delete all**  
**Mode.Parameter.Statistics.ResTab.DelN** **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 | <b>Mode.Parameter.Evaluation.EPC</b>                         | DET: | 0...5...200                      |
|          |                                                              | MET  | pH: 0.1...0.50...9.99            |
|          |                                                              |      | U, Ipol: 1...30...999            |
|          |                                                              |      | Upol: 0.1...2...99.9             |
|          | <b>Mode.Parameter.Evaluation.Recognition.Selected</b>        |      | all, greatest, last, window, OFF |
|          | <b>Mode.Parameter.Evaluation.Recognition.Window.1.LowLim</b> |      | pH: 0... ± 20.00, OFF            |
|          |                                                              |      | U, Ipol: 0... ± 2000, OFF        |
|          |                                                              |      | Upol: 0... ± 200.0, OFF          |
|          | <b>Mode.Parameter.Evaluation.Recognition.Window.1.UpLim</b>  |      | Input range as LowLim            |
|          | etc. up to 9 windows                                         |      |                                  |
|          | <b>Mode.Parameter.Evaluation.FixEP.1.Value</b>               |      | pH: 0... ± 20.00, OFF            |
|          |                                                              |      | U; Ipol: 0... ± 2000, OFF        |
|          |                                                              |      | Upol: 0... ± 200.0, OFF          |
|          | etc. up to 9 fix EP's                                        |      | ON, OFF                          |
|          | <b>Mode.Parameter.Evaluation.pK</b>                          |      |                                  |

Parameters for DET and MET: Evaluation of the EP's, see page 18.

.EPC: EP criterion in pH, in mV (with U and Ipol) or in µA (with Upol).

.Recognition.Selected: EP recognition.

all: All end points found are recognised.

great: Only the largest EP is recognised.

last: Only the last EP is recognised.

window: Only EP's that lie within set windows are recognised.

OFF: The EP evaluation is switched off.

.Recognition.Window.1.LowLim: Lower limit for window in pH, mV (with U and Ipol) or µA (with Upol).

.Recognition.Window.1.UpLim: Upper limit for window in pH, mV (with U and Ipol) or µA (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 21.

.FixEP.1.Val: Fix-EP's in pH, mV (bei U, Ipol) resp. µA (bei 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 | <b>Mode.Parameter.Presel.IReq</b> | id1, id1&2, all, OFF  |
|          | <b>Mode.Parameter.Presel.SReq</b> | 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. &SmpIData.OFFSilo.Id1 (see 3.2.2.113) or with &M \$G, siehe 3.2.2.1.

|          |                                      |                                 |         |
|----------|--------------------------------------|---------------------------------|---------|
| 3.2.2.27 | <b>Mode.Parameter.Presel.ActPuls</b> | DET, MET, STAT, DOS, DOC, MEAS: | ON, OFF |
|          |                                      | SET, KFT: first, all, cond.,    | OFF     |

Output of a pulse on the I/O line "activate", see page 196.

|          |                                   |          |                   |
|----------|-----------------------------------|----------|-------------------|
| 3.2.2.28 | <b>Mode.Parameter.SET1.EP</b>     | pH:      | 0... ± 20.00, OFF |
|          |                                   | U, Ipol: | 0... ± 2000, OFF  |
|          |                                   | Upol:    | 0... ± 200.0, OFF |
|          | <b>Mode.Parameter.SET1.UnitEp</b> |          | read only         |

Parameters for SET: Setting the 1st end point 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.

|          |                                    |          |                       |
|----------|------------------------------------|----------|-----------------------|
| 3.2.2.29 | <b>Mode.Parameter.SET1.Dyn</b>     | pH:      | 0.01...20.00, OFF     |
|          |                                    | U, Ipol: | 1...2000, OFF         |
|          |                                    | Upol:    | 0.1...200.0, OFF      |
|          | <b>Mode.Parameter.SET1.UnitDyn</b> |          | read only             |
|          | <b>Mode.Parameter.SET1.MaxRate</b> |          | 0.01...10...150, max. |
|          | <b>Mode.Parameter.SET1.MinRate</b> |          | 0.01...25.0...999.9   |

Parameters for SET: Control parameters, see page 29.

- .Dyn: Dynamics, control range in pH, mV (with U and lpol) or  $\mu$ A (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  $\mu$ L/min.

|          |                                       |                   |
|----------|---------------------------------------|-------------------|
| 3.2.2.30 | <b>Mode.Parameter.SET1.Stop.Type</b>  | drift, time       |
|          | <b>Mode.Parameter.SET1.Stop.Drift</b> | 1...20...999      |
|          | <b>Mode.Parameter.SET1.Stop.Time</b>  | 0...10...999, inf |
|          | <b>Mode.Parameter.SET1.Stop.StopT</b> | 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  $\mu$ l/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".

|          |                                          |            |
|----------|------------------------------------------|------------|
| 3.2.2.31 | <b>Mode.Parameter.TitrPara.Direction</b> | +, -, 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.

|          |                                       |             |
|----------|---------------------------------------|-------------|
| 3.2.2.32 | <b>Mode.Parameter.TitrPara.XPause</b> | 0...999 999 |
|----------|---------------------------------------|-------------|

Parameter for SET, KFT: Pause time in s. Runs before dosing the start volume.

|          |                                      |             |
|----------|--------------------------------------|-------------|
| 3.2.2.33 | <b>Mode.Parameter.TitrPara.ExtrT</b> | 0...999 999 |
|----------|--------------------------------------|-------------|

Parameter for SET, KFT: Extraction time in s.

|          |                                         |                 |
|----------|-----------------------------------------|-----------------|
| 3.2.2.34 | <b>Mode.Parameter.Presel.Cond</b>       | ON, OFF         |
|          | <b>Mode.Parameter.Presel.DriftDisp</b>  | ON, OFF         |
|          | <b>Mode.Parameter.Presel.DCor.Type</b>  | auto, man., OFF |
|          | <b>Mode.Parameter.Presel.DCor.Value</b> | 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: Taker-over of the drift value at start.
- .DCor.Value: Drift value for the manual drift correction.

|          |                                       |          |                       |
|----------|---------------------------------------|----------|-----------------------|
| 3.2.2.35 | <b>Mode.Parameter.CtrlPara.EP</b>     | pH:      | 0... $\pm$ 20.00, OFF |
|          |                                       | U, lpol: | 0... $\pm$ 2000, OFF  |
|          |                                       | Upol:    | 0... $\pm$ 200.0, OFF |
|          | <b>Mode.Parameter.CtrlPara.UnitEp</b> |          | read only             |

Parameters for KFT, STAT: Setting of the EP, resp. Control point as a pH value, in mV (with U and lpol) or  $\mu$ A (with Upol). The corresponding unit can be read with .UnitEP.

With KFT the standard value for lpol is 250 mV, for Upol 25  $\mu$ A.

|          |                                        |          |                          |
|----------|----------------------------------------|----------|--------------------------|
| 3.2.2.36 | <b>Mode.Parameter.CtrlPara.Dyn</b>     | pH:      | 0.01...20.00, <b>OFF</b> |
|          |                                        | U, Ipol: | 1...2000, <b>OFF</b>     |
|          |                                        | Upol:    | 0.1...200.0, <b>OFF</b>  |
|          | <b>Mode.Parameter.CtrlPara.UnitDyn</b> |          | read only                |
|          | <b>Mode.Parameter.CtrlPara.MaxRate</b> |          | 0.01...10...150, max.    |
|          | <b>Mode.Parameter.CtrlPara.MinIncr</b> |          | 0.1...9.9, <b>min.</b>   |

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.

|          |                                        |  |                     |
|----------|----------------------------------------|--|---------------------|
| 3.2.2.38 | <b>Mode.Parameter.CtrlPara.MinRate</b> |  | 0.01...25.0...999.9 |
|----------|----------------------------------------|--|---------------------|

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

|          |                                          |          |                             |
|----------|------------------------------------------|----------|-----------------------------|
| 3.2.2.39 | <b>Mode.Parameter.TitrPara.TStart</b>    |          | 0...999 999                 |
|          | <b>Mode.Parameter.TitrPara.StartMeas</b> | pH:      | 0.00... ± 20.00, <b>OFF</b> |
|          |                                          | U, Ipol: | 0... ± 2000, <b>OFF</b>     |
|          |                                          | Upol:    | 0.0... ± 200.0, <b>OFF</b>  |
|          | <b>Mode.Parameter.TitrPara.RateStart</b> |          | 0.01...150, <b>OFF</b>      |

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.

|          |                                       |  |                 |
|----------|---------------------------------------|--|-----------------|
| 3.2.2.40 | <b>Mode.Parameter.TitrPara.TDelta</b> |  | 1...2...999 999 |
|----------|---------------------------------------|--|-----------------|

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

|          |                                             |                                      |
|----------|---------------------------------------------|--------------------------------------|
| 3.2.2.41 | <b>Mode.Parameter.StopCond.TStop.Type</b>   | abs., rel., delta, delay, <b>OFF</b> |
|          | <b>Mode.Parameter.StopCond.TStop.Time</b>   | 0...999 999                          |
|          | <b>Mode.Parameter.StopCond.TStop.Factor</b> | 0... ± 999 99                        |
|          | <b>Mode.Parameter.StopCond.TStop.Delta</b>  | 0...999 999                          |
|          | <b>Mode.Parameter.StopCond.TStop.Delay</b>  | 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:

$$\text{Stop time in s} = \text{sample size} * \text{factor}$$

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.

|          |                                         |  |                        |
|----------|-----------------------------------------|--|------------------------|
| 3.2.2.42 | <b>Mode.Parameter.StopCond.RateStop</b> |  | 0.01...150, <b>OFF</b> |
|----------|-----------------------------------------|--|------------------------|

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.

3.2.2.43 **Mode.Parameter.Evaluation.TimeWin.1.LowLim** 0...999 999, **OFF**  
**Mode.Parameter.Evaluation.TimeWin.1.UpLim** 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).

3.2.2.44 **Mode.Parameter.Evaluation.FixVol.1.Value** 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.

3.2.2.45 **Mode.Parameter.Evaluation.FixTime.1.Value** 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.

3.2.2.46 **Mode.Parameter.Monitoring.MeasVal.Status** ON, **OFF**  
**Mode.Parameter.Monitoring.MeasVal.LowLim** pH: 0... ± 20.00  
**Mode.Parameter.Monitoring.MeasVal.UpLim** U, lpol: 0... ± 2000  
Upol: 0... ± 200.0  
**Mode.Parameter.Monitoring.MeasVal.Action** 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.

3.2.2.47 **Mode.Parameter.Monitoring.Rate.Status** ON, **OFF**  
**Mode.Parameter.Monitoring.Rate.LowLim** 0.000...150  
**Mode.Parameter.Monitoring.Rate.UpLim** 0.000...150  
**Mode.Parameter.Monitoring.Rate.Action** 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.

3.2.2.48 **Mode.Parameter.Monitoring.Temp.Status** ON, **OFF**  
**Mode.Parameter.Monitoring.Temp.LowLim** -170.0...500.0  
**Mode.Parameter.Monitoring.Temp.UpLim** -170.0...500.0  
**Mode.Parameter.Monitoring.Temp.Action** 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.

3.2.2.49 **Mode.Parameter.Monitoring.AssignOutput** meas, temp, rate, all, **none**  
**Mode.Parameter.Monitoring.Output** active, **pulse**

Parameters for STAT, DOS, DOC: Output of a signal on L4 output (pin 3) of the remote socket on limit value violation.

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

3.2.2.50 **Mode.Parameter.Presel.RateDisp** ON, OFF

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

|          |                                              |                       |
|----------|----------------------------------------------|-----------------------|
| 3.2.2.51 | <b>Mode.Parameter.DosPara.Type</b>           | volume, time, rate    |
|          | <b>Mode.Parameter.DosPara.Volume.Volume</b>  | 0.000...10...99999.99 |
|          | <b>Mode.Parameter.DosPara.Volume.DisType</b> | time, rate            |
|          | <b>Mode.Parameter.DosPara.Volume.Rate</b>    | 0.001...150, max.     |
|          | <b>Mode.Parameter.DosPara.Volume.Time</b>    | 1...100...999 999     |
|          | <b>Mode.Parameter.DosPara.Time.Time</b>      | 1...100...999 999     |
|          | <b>Mode.Parameter.DosPara.Time.DisType</b>   | volume, rate          |
|          | <b>Mode.Parameter.DosPara.Time.Rate</b>      | 0.001...150, max.     |
|          | <b>Mode.Parameter.DosPara.Time.Volume</b>    | 0.000...10...99999.99 |
|          | <b>Mode.Parameter.DosPara.Rate.Rate</b>      | 0.001...150, max.     |
|          | <b>Mode.Parameter.DosPara.Rate.StopType</b>  | volume, time          |
|          | <b>Mode.Parameter.DosPara.Rate.Time</b>      | 1...100...999 999     |
|          | <b>Mode.Parameter.DosPara.Rate.Volume</b>    | 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.

3.2.2.52 **Mode.Parameter.DosPara.Pause** 0...999 999

Parameters for DOS: Pause time in s.

3.2.2.53 **Mode.Parameter.DosPara.TDelta** 1...10...999 999

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

3.2.2.54 **Mode.Parameter.DosPara.Temp** -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.

|          |                                                        |                        |
|----------|--------------------------------------------------------|------------------------|
| 3.2.2.55 | <b>Mode.Parameter.Monitoring.MeasVal.MeasMode</b>      | pH, U, Ipol, Upol, OFF |
|          | <b>Mode.Parameter.Monitoring.MeasVal.MeasInput</b>     | 1, 2, diff.            |
|          | <b>Mode.Parameter.Monitoring.MeasVal.PCurrent</b>      | -127...1... + 127      |
|          | <b>Mode.Parameter.Monitoring.MeasVal.PVoltage</b>      | -1270...400... + 1270  |
|          | <b>Mode.Parameter.Monitoring.MeasVal.PolElectrTest</b> | ON, OFF                |
|          | <b>Mode.Parameter.Monitoring.MeasVal.pH.LowLim</b>     | 0... ± 20.00           |
|          | <b>Mode.Parameter.Monitoring.MeasVal.pH.UpLim</b>      | 0... ± 20.00           |
|          | <b>Mode.Parameter.Monitoring.MeasVal.U.LowLim</b>      | 0... ± 2000            |
|          | <b>Mode.Parameter.Monitoring.MeasVal.U.UpLim</b>       | 0... ± 2000            |
|          | <b>Mode.Parameter.Monitoring.MeasVal.Ipol.LowLim</b>   | 0... ± 2000            |
|          | <b>Mode.Parameter.Monitoring.MeasVal.Ipol.UpLim</b>    | 0... ± 2000            |
|          | <b>Mode.Parameter.Monitoring.MeasVal.Upol.LowLim</b>   | 0... ± 200.0           |
|          | <b>Mode.Parameter.Monitoring.MeasVal.Upol.UpLim</b>    | 0... ± 200.0           |
|          | <b>Mode.Parameter.Monitoring.MeasVal.Action</b>        | 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 187.

With Ipol, the requests for the polarisation current in uA (Ipol) and .PolElectrTest apply.

With Upol, the request for the polarisation voltage in mV (Upol) applies. Entry in steps of 10 mV.  
 .PolElectrTest also applies. If the test for polarised electrodes is switched on (ON), it is performed on the change from the inactive basic mode to an active mode.  
 On limit value violation, an action can be selected:  
 stop: Abort of the determination.  
 hold: Interrupt dosing until the sequence is continued by manual switching (& m \$C).  
 wait: Interrupt dosing until the limit value is no longer violated, then continue automatically.

|          |                                         |                                                                                                       |
|----------|-----------------------------------------|-------------------------------------------------------------------------------------------------------|
| 3.2.2.56 | <b>Mode.Parameter.DosPara.BeginMeas</b> | pH: 0... ± 20.00, <b>init</b><br>U, lpol: 0... ± 2000, <b>init</b><br>Upol: 0... ± 200.0, <b>init</b> |
|          | <b>Mode.Parameter.DosPara.EndMeas</b>   | as with .Begin, but OFF instead of init                                                               |
|          | <b>Mode.Parameter.DosPara.UnitMeas</b>  | read only                                                                                             |

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

|          |                                         |                            |
|----------|-----------------------------------------|----------------------------|
| 3.2.2.57 | <b>Mode.Parameter.DosPara.SweepTime</b> | 0... <b>300</b> ...999 999 |
|----------|-----------------------------------------|----------------------------|

Sweep time for the ramp in s.

|          |                                       |                                                                                                                                                     |
|----------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 3.2.2.58 | <b>Mode.Parameter.DosPara.Dyn</b>     | pH: 0.01... <b>0.25</b> ...20.00, OFF<br>U: 1... <b>15</b> ...2000, OFF<br>lpol: 1... <b>6</b> ...2000, OFF<br>Upol: 0.1... <b>10</b> ...200.0, OFF |
|          | <b>Mode.Parameter.DosPara.UnitDyn</b> | read only                                                                                                                                           |
|          | <b>Mode.Parameter.DosPara.MaxRate</b> | 0.01...150, <b>max.</b>                                                                                                                             |
|          | <b>Mode.Parameter.DosPara.MinRate</b> | 0.01... <b>5.0</b> ...999.9                                                                                                                         |

Parameters for DOC: Control parameters, see page 67.  
 .Dyn: Dynamics in pH, mV (with U and lpol) 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.

|          |                                         |                   |
|----------|-----------------------------------------|-------------------|
| 3.2.2.59 | <b>Mode.Parameter.DosPara.Direction</b> | +, -, <b>auto</b> |
|----------|-----------------------------------------|-------------------|

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.

|          |                                             |                         |
|----------|---------------------------------------------|-------------------------|
| 3.2.2.60 | <b>Mode.Parameter.DosPara.StartV.Type</b>   | abs., rel., <b>OFF</b>  |
|          | <b>Mode.Parameter.DosPara.StartV.V</b>      | <b>0</b> ...999.99      |
|          | <b>Mode.Parameter.DosPara.StartV.Factor</b> | <b>0</b> ... ± 999 999  |
|          | <b>Mode.Parameter.DosPara.StartV.Rate</b>   | 0.01...150, <b>max.</b> |
|          | <b>Mode.Parameter.DosPara.Pause</b>         | <b>0</b> ...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.

|          |                                             |                       |
|----------|---------------------------------------------|-----------------------|
| 3.2.2.61 | <b>Mode.Parameter.DosPara.MeasInput</b>     | 1, 2, diff.           |
|          | <b>Mode.Parameter.DosPara.Ipol</b>          | -127...1... + 127     |
|          | <b>Mode.Parameter.DosPara.Upol</b>          | -1270...400... + 1270 |
|          | <b>Mode.Parameter.DosPara.PolElectrTest</b> | 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 187.

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.

|          |                                              |                                |
|----------|----------------------------------------------|--------------------------------|
| 3.2.2.62 | <b>Mode.Parameter.Measuring.SignalDrift</b>  | pH, U, Ipol, T: 0.5...999, OFF |
|          |                                              | Upol: 0.05...99.9, OFF         |
|          | <b>Mode.Parameter.Measuring.UnitSigDrift</b> | read only                      |
|          | <b>Mode.Parameter.Measuring.EquTime</b>      | 0...9999, OFF                  |

Parameters for MEAS: Criteria for the measured value acquisition. Measured value drift in mV/min (with pH, U, Ipol, T),  $\mu$ A/min (with Upol), resp. °C/min (with T). Equilibration time in s. OFF means that the corresponding criterion is switched off. If both criteria are OFF, the measurement continues indefinitely.

If the equilibration time has never been edited, it is automatically calculated by the instrument to match the drift, see page 54. After it has been edited once, it remains in force with the set value.

|          |                                               |                       |
|----------|-----------------------------------------------|-----------------------|
| 3.2.2.63 | <b>Mode.Parameter.Measuring.MeasInput</b>     | 1, 2, diff.           |
|          | <b>Mode.Parameter.Measuring.Ipol</b>          | -127...1... + 127     |
|          | <b>Mode.Parameter.Measuring.Upol</b>          | -1270...400... + 1270 |
|          | <b>Mode.Parameter.Measuring.PolElectrTest</b> | ON, OFF               |

Parameters for MEAS:

Selection of the measuring input; valid with measured quantities pH and U. "diff." means differential amplifier, see page 187.

With Ipol, the inquiries for the polarization current in  $\mu$ A (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 changeover from the inactive state to the measurement.

|          |                                      |                       |
|----------|--------------------------------------|-----------------------|
| 3.2.2.64 | <b>Mode.Parameter.Measuring.Temp</b> | -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.

|          |                                             |             |
|----------|---------------------------------------------|-------------|
| 3.2.2.65 | <b>Mode.Parameter.Calibration.MeasInput</b> | 1, 2, diff. |
|----------|---------------------------------------------|-------------|

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

|          |                                           |                      |
|----------|-------------------------------------------|----------------------|
| 3.2.2.66 | <b>Mode.Parameter.Calibration.CalTemp</b> | -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.

|          |                                                  |                               |
|----------|--------------------------------------------------|-------------------------------|
| 3.2.2.67 | <b>Mode.Parameter.Calibration.Buffer.1.Value</b> | -20.00...7.00... + 20.00      |
|          | <b>Mode.Parameter.Calibration.Buffer.2.Value</b> | -20.00...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.

3.2.2.68 **Mode.Parameter.Calibration.SignalDrift** 0.5...2...999, OFF  
**Mode.Parameter.Calibration.EquTime** 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 18. After it has been edited once, it remains in force with the set value.

3.2.2.69 **Mode.Parameter.Calibration.ElectrodeId** up to 8 ASCII char

Parameters for CAL: Electrode identification. It is classified under calibration data, see 3.2.2.121.

3.2.2.70 **Mode.Parameter.Calibration.SmplChanger** ON, OFF

Parameters for CAL: Calibration at sample changer.

With "ON", there are no hold points in the calibration sequence for entries, the first buffer is measured directly.

3.2.2.71 **Mode.Parameter.Calibration.ActPulse** first, all, OFF

Parameters for CAL: Output of a pulse on the I/O line "activate", see page 197.

3.2.2.72 **Mode.Parameter.Sequence.X.Select** method, pause, L4 output, L6 output, info, prep, OFF

Parameters for TIP: Selection of an element for step X (X = 1...30). For the parameters of the elements see 3.2.2.73.

3.2.2.73 **Mode.Parameter.Sequence.X.Method** Method name from the user memory  
**Mode.Parameter.Sequence.X.Pause** 0...999 999, INF  
**Mode.Parameter.Sequence.X.L4Output** active, inactive, pulse, OFF  
**Mode.Parameter.Sequence.X.L6Output** active, inactive, pulse, OFF  
**Mode.Parameter.Sequence.X.Info** up to 16 ASCII characters

Parameters for TIP: Parameters of the elements of TIP.

.Method: Method name of a method available in the user memory. Up to 8 ASCII characters.  
.Pause: Pause time in s. INF means infinite. Continue the sequence with &m \$G.  
.L4 Output: Warning: A pulse triggered by the limit value monitoring at L4 (pin 3) in a submethod sets an output set to active in TIP to inactive.  
.L6 Output: Warning: An activate pulse at L6 output (pin 1) in a submethod sets an output set to active in TIP to inactive.  
.Info: Entry of a message which is written into the display. The sequence remains in the display with the corresponding message. Continue with &m \$G.  
.Prep: Preparation of titrating burette.

3.2.2.74 **Mode.Parameter.Presel.MeasMode** pH, U, Ipol, Upol, OFF  
**Mode.Parameter.Presel.MeasInput** 1, 2, diff.  
**Mode.Parameter.Presel.Ipol** -127...1... + 127  
**Mode.Parameter.Presel.Upol** -1270...400... + 1270  
**Mode.Parameter.Presel.PolElectrTest** ON, OFF  
**Mode.Parameter.Presel.Temp** -170.....25.0...500.0

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

3.2.2.75 **UserMeth.FreeMem** read only

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

|          |                             |                          |
|----------|-----------------------------|--------------------------|
| 3.2.2.76 | <b>UserMeth.Recall</b>      | \$G                      |
|          | <b>UserMeth.Recall.Name</b> | up to 8 ASCII characters |
|          | <b>UserMeth.Store</b>       | \$G                      |
|          | <b>UserMeth.Store.Name</b>  | up to 8 ASCII characters |
|          | <b>UserMeth.Delete</b>      | \$G                      |
|          | <b>UserMeth.Delete.Name</b> | up to 8 ASCII characters |
|          | <b>UserMeth.DelAll</b>      | \$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.

|          |                                 |           |
|----------|---------------------------------|-----------|
| 3.2.2.77 | <b>UserMeth.List.1.Name</b>     | read only |
|          | <b>UserMeth.List.1.Mode</b>     | read only |
|          | <b>UserMeth.List.1.Quantity</b> | read only |
|          | <b>UserMeth.List.1.DosUnit</b>  | read only |
|          | <b>UserMeth.List.1.Bytes</b>    | read only |
|          | <b>UserMeth.List.1.Checksum</b> | 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 3.2.2.123.                |

|          |                               |                          |
|----------|-------------------------------|--------------------------|
| 3.2.2.78 | <b>MemoryCard.Recall</b>      | \$G                      |
|          | <b>MemoryCard.Recall.Name</b> | up to 8 ASCII characters |
|          | <b>MemoryCard.Store</b>       | \$G                      |
|          | <b>MemoryCard.Store.Name</b>  | up to 8 ASCII characters |
|          | <b>MemoryCard.Delete</b>      | \$G                      |
|          | <b>MemoryCard.Delete.Name</b> | 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!

3.2.2.79 **MemoryCard.ChangeDir** \$G  
**MemoryCard.ChangeDir.Name** up to 10 ASCII characters  
**MemoryCard.ChangeDir.Checksum** \$G  
**MemoryCard.ChangeDir.Checksum.Value** 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 characterises the content of the directory.

3.2.2.80 **MemoryCard.CreateDir** \$G  
**MemoryCard.CreateDir.Name** 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!

3.2.2.81 **MemoryCard.DelDir** \$G  
**MemoryCard.DelDir.Name** 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!

3.2.2.82 **MemoryCard.Backup** \$G  
**MemoryCard.Backup.Name** 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!

3.2.2.83 **MemoryCard.Reload** \$G  
**MemoryCard.Reload.Name** 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!

3.2.2.84 **MemoryCard.Format** \$G  
**MemoryCard.CardLabel.Name** 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!

3.2.2.85 **MemoryCard.FreeMem** read only

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

3.2.2.86 **MemoryCard.BatteryChange** \$G  
**MemoryCard.BatteryChange.Date** YYYY-MM-DD

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

3.2.2.87 **MemoryCard.List.Card.1.Name** read only  
**MemoryCard.List.Card.1.Bytes** 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

3.2.2.88 **MemoryCard.List.ActDir.1.Name** read only  
**MemoryCard.List.ActDir.1.Mode** read only  
**MemoryCard.List.ActDir.1.Quantity** read only  
**MemoryCard.List.ActDir.1.DosUnit** read only  
**MemoryCard.List.ActDir.1.Bytes** read only  
**MemoryCard.List.ActDir.1.Checksum** 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 3.2.2.123.

3.2.2.89 **Config.PeriphUnit.CharSet** Epson, Seiko, Citizen, HP, **IBM**  
Selection of the character set and the graphics control characters.  
IBM means the IBM character set following character set table 437 and IBM graphics control characters.  
Select 'IBM' for work with the computer.

3.2.2.90 **Config.PeriphUnit.Balance** Sartorius, Mettler, Mettler AT, AND, Precisa  
**Config.PeriphUnit.Plot** U, dU/dt, V, dV/dt, U(rel), T  
Selection of the balance type and the signal for the output at the analog output.

3.2.2.91 **Config.Aux.Language** english, deutsch, francais, espanol, portuguese, italiano, svenska  
Selection of the dialog language.

3.2.2.92 **Config.Aux.Set** \$G  
**Config.Aux.Set.Date** YYYY-MM-DD  
**Config.Aux.Set.Time** 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.

3.2.2.93 **Config.Aux.RunNo** 0...9999  
Current sample number.  
Set to 0 on power on and initialisation. After 9999, counting starts again at 0.

3.2.2.94 **Config.Aux.AutoStart** 1...9999, **OFF**  
Number of automatic, internal starts.

3.2.2.95 **Config.Aux.StartDelay** 0...999 999

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

3.2.2.96 **Config.Aux.DevName** up to 8 ASCII characters

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

If a name has been entered, it will be printed out in the result report (full, short).

3.2.2.97 **Config.Aux.Prog** read only

Output of the program version.

The Titrino sends "736.0010" on requests with \$Q.

3.2.2.98 **Config.RSSet** \$G

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

|                                   |                                         |
|-----------------------------------|-----------------------------------------|
| 3.2.2.99 <b>Config.RSSet.Baud</b> | 300, 600, 1200, 2400, 4800, <b>9600</b> |
| <b>Config.RSSet.DataBit</b>       | <b>7, 8</b>                             |
| <b>Config.RSSet.StopBit</b>       | <b>1, 2</b>                             |
| <b>Config.RSSet.Parity</b>        | even, odd, <b>none</b>                  |
| <b>Config.RSSet.Handsh</b>        | <b>HWs, HWf, SWchar, SWline, none</b>   |

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 155 ff.

The setting of the values must be initiated with \$G immediately after entry of the values, see 3.2.2.98.

3.2.2.101 **Config.ComVar.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

3.2.2.101 **Config.DosPrep.PowerOnPrep** ON, OFF

Warning after power on, that the preparation of the buret has to be executed.

3.2.2.102 **Config.DosPrep.Report** ON, OFF

Report output after preparation of burets.

3.2.2.103 **Config.DosPrep.Select** internal D0, external D1, external D2

Selection of buret.

3.2.2.104 **Config.DosPrep.DX.WarnInterval** 5...9999, OFF

Time interval in min for automatic warning that a preparation has to be executed.

- 3.2.2.105 **Config.DosPrep.DX(.Dosimat).V** 0...3.5...99999.99  
 Volume in ml, which will be expelled at the preparation. Start sequence see 3.2.2.140.
- 3.2.2.106 **Config.DosPrep.DX(.Dosimat).Repeat** 1...2...9  
 Number of cycles for expelling the volume at the preparation. Start sequence see 3.2.2.140.
- 3.2.2.107 **Config.DosPrep.DX(.Dosimat).DosRate** 0.01...150, **max.**  
**Config.DosPrep.DX(.Dosimat).FillRate** 0.01...150, **max.**  
 Dosing and filling rate in ml/in for the preparation. Start sequence see 3.2.2.140.
- 3.2.2.108 **Config.DosPrep.DX.Select** **Dosimat, Dosino**  
 Selection of buret type. Start sequence see 3.2.2.140.
- 3.2.2.109 **Config.DosPrep.DX.Dosino.Outlet** tip, **flask**  
 Place where the liquid of the preparation is expelled. Start sequence see 3.2.2.140.  
 tip: To the tip.  
 flask: Back to the flask.
- 3.2.2.110 **Config.DosPrep.DX.Dosino.DosTubing.Length** 1...40...999.9  
**Config.DosPrep.DX.Dosino.DosTubing.Diameter** 0.1...2...9.9  
**Config.DosPrep.DX.Dosino.AspirTubing.Length** 1...25...999.9  
**Config.DosPrep.DX.Dosino.AspirTubing.Diameter** 0.1...2...9.9  
 .DosTubing: Dosing tube. Length in cm, diameter in mm.  
 .AspirTubing: Aspiration tube. Length in cm, diameter in mm.  
 Start sequence see 3.2.2.140.
- 3.2.2.111 **Config.DosPrep.DX.Dosino.DosRate** 0.01...150, **max.**  
**Config.DosPrep.DX.Dosino.FillRate** 0.01...150, **max.**  
 Dosing and filling rate in ml/min for preparation. Start sequence see 3.2.2.140.
- 3.2.2.112 **SmplData.Status** 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.
- 3.2.2.113 **SmplData.OFFSilo.Id1** up to 8 ASCII characters  
**SmplData.OFFSilo.Id2** up to 8 ASCII characters  
**SmplData.OFFSilo.Id3** up to 8 ASCII characters  
**SmplData.OFFSilo.ValSmpl** 6-digit number with sign and decimal point  
**SmplData.OFFSilo.UnitSmpl** 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.

3.2.2.114 **SmplData.ONSil.Counter.MaxLines** read only  
**SmplData.ONSil.Counter.FirstLine** read only  
**SmplData.ONSil.Counter.LastLine** read only

Information on silo memory.

.MaxLines: Maximum possible number of silo lines.

.FirstLine: Lowest valid silo line.

.LastLine: Last occupied silo line.

3.2.2.115 **SmplData.ONSil.EditLine.1.Method** up to 8 ASCII characters  
**SmplData.ONSil.EditLine.1.Id1** up to 8 ASCII characters  
**SmplData.ONSil.EditLine.1.Id2** up to 8 ASCII characters  
**SmplData.ONSil.EditLine.1.Id3** up to 8 ASCII characters  
**SmplData.ONSil.EditLine.1.ValSmpl** 6-digit number with sign and decimal point  
**SmplData.ONSil.EditLine.1.UnitSmpl** up to 5 ASCII characters  
**SmplData.ONSil.EditLine.1.C24** read only  
**SmplData.ONSil.EditLine.1.C25** read only  
**SmplData.ONSil.EditLine.1.Mark** read only  
 etc, up to .99

Contents of a silo line.

.Method: Method used to process the sample, from the method memory.

.Id: The identifications Id1...Id3 can also be used as sample-specific calculation constants C21...C23 in formulas.

.UnitSmpl: If "no unit" is desired for the sample size, the blank string must be entered.

.C24, .C25: Results which have been assigned to C24 and C25.

.Mark: Mark of the silo line: "\*" = deleted line, "+" = line which is worked off, "-" = line which is worked off and not valid for silo calculations (deleted), "/" = last worked-off line, where recalculation can still be done. Silo lines which have been worked off are "read only".

3.2.2.116 **SmplData.ONSil.DelLine** \$G  
**SmplData.ONSil.DelLine.LineNum** 1...99, **OFF**

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

3.2.2.117 **SmplData.ONSil.DelAll** \$G

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

3.2.2.118 **SmplData.ONSil.CycleLines** ON, **OFF**

Silo data cycling.

With "ON", executed lines are copied to the next free silo lines, see page 92. Exercise caution if you edit the silo memory during the determinations!

3.2.2.119 **SmplData.ONSil.SaveLines** 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 3.2.2.118.

3.2.2.120 **Info.Report** \$G  
**Info.Report.Select** configuration, parameters, smpl data, statistics, silo, calib, C-fmla, def, user method, **full**, short, mplist, curve, deriv, comb, meas crv, temp crv,scalc full, scalc srt, prep, calc, act dir, mem card, all, ff

\$G sends the selected report:

- configuration: Configuration report. Is not accessible during a running determination.
- parameters: Parameter report of the current method. During a running determination only "live"-parameters are accessible.
- smpl data: Current sample data.
- statistics: Statistics table with the individual results.
- silos: Contents of the silo memory.
- calib: Calibration data of the measuring input in the current method.
- C-fmla: Contents of the <C-fmla> key.
- def: Contents of the <def> key.
- user method: Contents of the method memory.
- full: Full result report of the last completed determination.
- short: Short result report of the last completed determination.
- mplist: Measuring point list of the running determination (with DET, MET, STAT, DOS, DOC).
- curve: Titration curve of the last determination (with DET, MET, STAT, DOS, DOC).
- 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).
- scal full: Full report of the silo calculations.
- scal 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 Titrimo are marked with space (ASCII32) and ' at the beginning. Then an individual identifier for each report follows. Reports which are triggered by RS232 (\$G) have the same introducer but without preceding space, i.e. they start with '.

|           |                                              |                           |           |
|-----------|----------------------------------------------|---------------------------|-----------|
| 3.2.2.121 | <b>Info.CalibrationData</b>                  |                           | \$G       |
|           | <b>Info.CalibrationData.Inp1.pHas</b>        | -20.00...7.00... + 20.00  |           |
|           | <b>Info.CalibrationData.Inp1.Slope</b>       | -9.999...1.000... + 9.999 |           |
|           | <b>Info.CalibrationData.Inp1.Temp</b>        | -170.0...25.0... + 500.0  |           |
|           | <b>Info.CalibrationData.Inp1.Date</b>        |                           | read only |
|           | <b>Info.CalibrationData.Inp1.ElectrodeId</b> |                           | 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 3.2.2.69.

Calibration data can be entered. They are accepted with &Info.CalibrationData \$G. If calibration data are entered, the calibration date is deleted.

|           |                              |                           |           |
|-----------|------------------------------|---------------------------|-----------|
| 3.2.2.122 | <b>Info.PrepData.D0.Date</b> |                           | read only |
|           | <b>Info.PrepData.D0.Time</b> | -20.00...7.00... + 20.00  |           |
|           | <b>Info.PrepData.D0.Type</b> | -9.999...1.000... + 9.999 |           |
|           | <b>Info.PrepData.D0.Date</b> |                           | read only |
|           | <b>Info.PrepData.D0.Time</b> |                           | read only |
|           | identical to.D2              |                           |           |

Data from the last correctly executed preparation.

|           |                                    |  |           |
|-----------|------------------------------------|--|-----------|
| 3.2.2.123 | <b>Info.Checksums</b>              |  | \$G       |
|           | <b>Info.Checksums.MPList</b>       |  | read only |
|           | <b>Info.Checksums.ActualMethod</b> |  | 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.

|           |                                    |                        |
|-----------|------------------------------------|------------------------|
| 3.2.2.124 | Info.DetermData                    | \$G                    |
|           | Info.DetermData.Write              | ON, OFF                |
|           | Info.DetermData.MPList.1.Attribute | read only/read + write |
|           | Info.DetermData.ExV                | read only/read + write |
|           | Info.DetermData.MPList.1.X         | read only/read + write |
|           | Info.DetermData.MPList.1.Y         | read only/read + write |
|           | Info.DetermData.MPList.1.Z1        | read only/read + write |
|           | Info.DetermData.MPList.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.

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

|           |                             |                        |
|-----------|-----------------------------|------------------------|
| 3.2.2.125 | Info.TitrResults.RS.1.Value | read only              |
|           | etc, up to .9               |                        |
|           | Info.TitrResults.EP.1.V     | read only              |
|           | Info.TitrResults.EP.1.Meas  | read only              |
|           | etc, up to .2               |                        |
|           | Info.TitrResults.Var.C40    | read only/read + write |
|           | etc, up to .C47             |                        |
|           | Info.TitrResults.Var.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  $\mu$ A (with Upol) "43.7".

.Var: Various variables. You may overwrite the variables C40...C45, see 3.2.2.124.

C40: Initial measured value in pH "5.12", mV (with U and Ipol) "-241",  $\mu$ A (with Upol) "43.7" or °C (withT) "25.0".

C41: End volume with SET, STAT, DOS, DOC in ml, "12.5360".

C42: Time from start of titration to end in s, "62".

C43: Volume drift on start of a SET/KFT titration from the conditioning in  $\mu$ L/min, "3.5".

C44: Temperature in °C. Used for the temperature compensation in pH measurements.

C45: Start volume with SET, STAT, DOC in ml, "2.800".

C46: Asymmetry pH of CAL, "6.89".

C47: Relative electrode slope of CAL, "0.9950".

DTime: Dosing time in s in DOS or time for the drift correction in SET/KFT with conditioning, resp.

3.2.2.126 **Info.TitrResults.FixEP.51.Value** read only  
 etc. up to **.59**  
**Info.TitrResults.pK.61.Value** read only  
 etc. up to **.69**  
**Info.TitrResults.TempVar.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.

3.2.2.127 **Info.TitrResults.TimeWin.81.Mean** read only  
**Info.TitrResults.TimeWin.81.Dev** read only  
 etc. up to **.89**  
**Info.TitrResults.MeanRateC80.Mean** read only  
**Info.TitrResults.MeanRateC80.Dev** 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.

3.2.2.128 **Info.StatisticsVal.ActN** read only  
**Info.Statistics.1.Mean** read only  
**Info.Statistics.1.Std** read only  
**Info.Statistics.1.RelStd** read only  
 etc. up to **.9**

The current values of the statistics calculation.

ActN: Current value of the individual results

\$Q sends, e.g.  
 "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"

3.2.2.129 **Info.SiloCalc.C24.Name** read only  
**Info.SiloCalc.C24.Value** read only  
**Info.SiloCalc.C24.Unit** read only  
 for **.C25** as for **.C24**  
**Info.SiloCalc.C26.ActN** read only  
**Info.SiloCalc.C26.Mean** read only  
**Info.SiloCalc.C26.Std** read only  
**Info.SiloCalc.C26.RelStd** 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.

C24.Name: Name of the assigned value

\$Q sends  
 "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"



|           |                                       |           |
|-----------|---------------------------------------|-----------|
| 3.2.2.130 | <b>Info.ActualInfo.Inputs.Status</b>  | read only |
|           | <b>Info.ActualInfo.Inputs.Change</b>  | read only |
|           | <b>Info.ActualInfo.Inputs.Clear</b>   | \$G       |
|           | <b>Info.ActualInfo.Outputs.Status</b> | read only |
|           | <b>Info.ActualInfo.Outputs.Change</b> | read only |
|           | <b>Info.ActualInfo.Outputs.Clear</b>  | \$G       |

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

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

Output:  $2^1 + 2^3 = "10"$

1 means ON or change; 0 means OFF or no change.

The lines are assigned as follows (see also pages 161ff):

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

|           |                                        |           |
|-----------|----------------------------------------|-----------|
| 3.2.2.131 | <b>Info.ActualInfo.Assembly.CyclNo</b> | 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 3.2.2.137), 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.

|           |                                               |           |
|-----------|-----------------------------------------------|-----------|
| 3.2.2.132 | <b>Info.ActualInfo.Assembly.Counter.V</b>     | read only |
|           | <b>Info.ActualInfo.Assembly.Counter.Clear</b> | \$G       |

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

|           |                                           |           |
|-----------|-------------------------------------------|-----------|
| 3.2.2.133 | <b>Info.ActualInfo.Assembly.PistonPos</b> | read only |
|           | <b>Info.ActualInfo.Assembly.Meas</b>      | read only |

Piston position and measured value in mV from assembly.

Piston position:

- 0 = initial position (filled)
- 10 000 = end position (empty)

|           |                                  |           |
|-----------|----------------------------------|-----------|
| 3.2.2.134 | Info.ActualInfo.Titrator.CyclNo  | read only |
|           | Info.ActualInfo.Titrator.V       | read only |
|           | Info.ActualInfo.Titrator.Meas    | read only |
|           | Info.ActualInfo.Titrator.dVdt    | read only |
|           | Info.ActualInfo.Titrator.dMeasdt | read only |
|           | Info.ActualInfo.Titrator.dMeasdV | read only |
|           | Info.ActualInfo.Titrator.ERC     | read only |
|           | Info.ActualInfo.Titrator.T       | read only |

\$Q sends the current values in the following formats:

|                 | DET    | MET    | SET      | KFT     | STAT,<br>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              | 3.456  | 3.456  | 3.6 (mV) | -       | 3.6 (mV)     | 3.6 (mV) | 3.456  | 3.456  |
| 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   | 25.0   | -        | -       | -            | -        | 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   | -      |

NV: Not Valid. If in the 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 3.2.2.137). The cycle number is set to 0 at the start of a method and it is incremented until the end of the method.

|           |                              |           |
|-----------|------------------------------|-----------|
| 3.2.2.135 | Info.ActualInfo.MeasPt.Index | read only |
|           | Info.ActualInfo.MeasPt.X     | read only |
|           | Info.ActualInfo.MeasPt.Y     | read only |
|           | Info.ActualInfo.MeasPt.Z1    | read only |
|           | Info.ActualInfo.MeasPt.Z2    | read only |
|           | Info.ActualInfo.EP.Index     | read only |
|           | Info.ActualInfo.EP.X         | read only |
|           | Info.ActualInfo.EP.Y         | read only |

\$Q sends the last entry into the measuring point list (.MeasPt) with DET, MET, STAT, DOS, DOC 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), resp. of the MPList in s                     |
| .MeasPt.Y" 3.654" | Measured value (DET, MET), volume (STAT, DOS, DOC), resp. of the MPList in mL          |
| .MeasPt.Z1" 6.34" | Measured value (STAT, DOS, DOC) of the MPList, format depends on the measured quantity |
| .MeasPt.Z2" 25.8" | Temperature (STAT, DOS, DOC) of the MPList in °C                                       |
| .EP.X" 1.234"     | Volume coordinate of the EP                                                            |
| .EP.Y" 5.34"      | Measured value coordinate of the EP                                                    |

|           |                            |                           |
|-----------|----------------------------|---------------------------|
| 3.2.2.136 | Info.ActualInfo.Display.L1 | up to 24 ASCII characters |
|           | Info.ActualInfo.Display.L2 | up to 24 ASCII characters |

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

The display is not operated by the Titrino if 'Setup.Lock.Display' is set to ON, see 3.2.2.149.

\$Q sends the contents of the corresponding display line.

3.2.2.137 **Info.Assembly.CycleTime** read only  
**Info.Assembly.ExV** read only

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

3.2.2.138 **Info.Assembly.Select** internal D0, external D1, external D2

Selection of buret for assembly functions.

3.2.2.139 **Info.Assembly.Empty** \$G, \$\$, \$H, \$C

Starts the function "empty". Only possible with the burette type "Dosino". The parameters are under the function &Config.DosPrep, see 3.2.2.109 up to 3.2.2.111.

3.2.2.140 **Info.Assembly.Prep** \$G, \$\$, \$H, \$C

Starts the function "preparation". The parameters are under the function &Config.DosPrep, see 3.2.2.104 up to 3.2.2.111.

3.2.2.141 **Assembly.Bur.Rates.Forward.Selected** digital, analog  
**Assembly.Bur.Rates.Forward.Digital** 0...150, max.  
**Assembly.Bur.Rates.Reverse.Selected** digital, analog  
**Assembly.Bur.Rates.Reverse.Digital** 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.

3.2.2.142 **Assembly.Bur.Fill** \$G, \$H, \$C

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

3.2.2.143 **Assembly.Bur.ModeDis** \$G, \$\$, \$H, \$C  
**Assembly.Bur.ModeDis.Selected** volume, time  
**Assembly.Bur.ModeDis.V** 0.0001...0.1...9999  
**Assembly.Bur.ModeDis.Time** 0.25...1...86400  
**Assembly.Bur.ModeDis.VStop** 0.0001...9999, OFF  
**Assembly.Bur.ModeDis.AutoFill** 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.

3.2.2.144 **Assembly.Meas.Status** ON, OFF  
**Assembly.Meas.MeasInput** 1, 2, Diff., Ipol, Upol, Temp  
**Assembly.Meas.Ipol** -127...1... + 127  
**Assembly.Meas.Upol** -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: Polarisation current in  $\mu\text{A}$ .  
 .Upol: Polarisation potential in mV, entry in steps of 10 mV.

3.2.2.145 **Assembly.Outputs.AutoEOD** ON, OFF  
**Assembly.Outputs.SetLines** \$G  
**Assembly.Outputs.SetLines.L1** active, inactive, pulse, OFF  
 up to .L3  
**Assembly.Outputs.ResetLines** \$G

Setting the I/O output lines.

.AutoEOD: The automatic output of the EOD (End of Determination) at the end of the determination can be switched off. Thus, for example, in conjunction with a sample changer several determinations can be performed in the same beaker. Before AutoEOD is switched on, line 2 must be set to "OFF".  
 .SetLines: With \$G, lines 1, 2 and 3 are set.  
 .SetLines.LX: Set the line LX. "active" means setting of a static signal, "inactive" means resetting of the signal, "pulse" means output of a pulse of app. 150 ms, "OFF" means the line is not operated, see also page 194.  
 L2 is the EOD line. Warning: If you have "AutoEOD" to "ON", an active line 2 is set to "inactive" by the EOD pulse.  
 L3 is the line of the activate pulse. Warning: An active line 3 is set to "inactive" by the activate pulse.  
 .ResetLines: Lines 1, 2 and 3 are set to the inactive status (= high).

3.2.2.146 **Setup.Keycode** ON, OFF

ON means the key code of a key pressed on the STAT Titrino is outputted. The key code comprises 2 ASCII characters; table of the keys with their code, see page 168. A keystroke of key 11 is sent as follows:  
 #11

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

3.2.2.147 **Setup.Tree.Short** ON, OFF  
**Setup.Tree.ChangedOnly** 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.

3.2.2.148 **Setup.Trace** 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).

3.2.2.149 **Setup.Lock.Keyboard** ON, OFF  
**Setup.Lock.Config** ON, OFF  
**Setup.Lock.Parameter** ON, OFF  
**Setup.Lock.SmplData** ON, OFF  
**Setup.Lock.UserMeth.Recall** ON, OFF  
**Setup.Lock.UserMeth.Store** ON, OFF  
**Setup.Lock.UserMeth.Delete** ON, OFF  
**Setup.Lock.Display** 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.

3.2.2.150 **Setup.Mode.StartWait** ON, OFF  
**Setup.Mode.FinWait** ON, OFF

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

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

3.2.2.151 **Setup.SendMeas.SendStatus** ON, OFF  
**Setup.SendMeas.Interval** 0.08...4...16200, MPLList

- .SendStatus: ON means the automatic transmission of measured values (see 3.2.2.153 and 3.2.2.154) in the inputted interval is active.
- .Interval: Time interval (in s) for the automatic transmission of associated measured values defined under points 3.2.2.153 and 3.2.2.154. 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 "MPLList" the measured values are sent at the time of their entry into the measured point list (in modes MET, DET, STAT, DOS, DOC; in the modes SET, MEAS, CAL nothing is being sent).

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

3.2.2.152 **Setup.SendMeas.Select** Assembly, Titrator

Selection of the unit of which the measured values should be sent (3.2.2.153 or 3.2.2.154).

3.2.2.153 **Setup.SendMeas.Assembly.CyclNo** ON, OFF  
**Setup.SendMeas.Assembly.V** ON, OFF  
**Setup.SendMeas.Assembly.Meas** ON, OFF

Selection of the values from Assembly for the output in the set time interval (see 3.2.2.151):

- .CyclNo: Cycle number of the potential measurement. Together with the cycle time (3.2.2.137), 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 3.2.2.152).

|           |                                        |         |
|-----------|----------------------------------------|---------|
| 3.2.2.154 | <b>Setup.SendMeas.Titrator.CyclNo</b>  | ON, OFF |
|           | <b>Setup.SendMeas.Titrator.V</b>       | ON, OFF |
|           | <b>Setup.SendMeas.Titrator.Meas</b>    | ON, OFF |
|           | <b>Setup.SendMeas.Titrator.dVdt</b>    | ON, OFF |
|           | <b>Setup.SendMeas.Titrator.dMeasdt</b> | ON, OFF |
|           | <b>Setup.SendMeas.Titrator.dMeasdV</b> | ON, OFF |
|           | <b>Setup.SendMeas.Titrator.ERC</b>     | ON, OFF |
|           | <b>Setup.SendMeas.Titrator.T</b>       | ON, OFF |

Selection of the values from the titrator which are sent in the set time interval (see 3.2.2.151, formats see 3.2.2.134):

- .CyclNo: Cycle number. Together with the cycle time (3.2.2.137), 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 3.2.2.152).

|           |                              |         |
|-----------|------------------------------|---------|
| 3.2.2.155 | <b>Setup.AutoInfo.Status</b> | ON, OFF |
|           | <b>Setup.AutoInfo.P</b>      | ON, OFF |
|           | <b>Setup.AutoInfo.T.R</b>    | ON, OFF |
|           | <b>Setup.AutoInfo.T.G</b>    | ON, OFF |
|           | <b>Setup.AutoInfo.T.GC</b>   | ON, OFF |
|           | <b>Setup.AutoInfo.T.S</b>    | ON, OFF |
|           | <b>Setup.AutoInfo.T.B</b>    | ON, OFF |
|           | <b>Setup.AutoInfo.T.F</b>    | ON, OFF |
|           | <b>Setup.AutoInfo.T.E</b>    | ON, OFF |
|           | <b>Setup.AutoInfo.T.H</b>    | ON, OFF |
|           | <b>Setup.AutoInfo.T.C</b>    | ON, OFF |
|           | <b>Setup.AutoInfo.T.O</b>    | ON, OFF |
|           | <b>Setup.AutoInfo.T.N</b>    | ON, OFF |
|           | <b>Setup.AutoInfo.T.Re</b>   | ON, OFF |
|           | <b>Setup.AutoInfo.T.Si</b>   | ON, OFF |
|           | <b>Setup.AutoInfo.T.M</b>    | ON, OFF |
|           | <b>Setup.AutoInfo.T.EP</b>   | ON, OFF |
|           | <b>Setup.AutoInfo.T.RC</b>   | ON, OFF |
|           | <b>Setup.AutoInfo.I</b>      | ON, OFF |
|           | <b>Setup.AutoInfo.O</b>      | 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 (3.2.2.157). Not from mains.

Messages from node .T, Titrator:

- .T.R Ready: Status 'Ready' has been reached.
- .T.G Go: Instrument has been started.
- .T.GC GoCommand: Instrument (or submethod in TIP) has received a go command.
- .T.S Stop: Status 'Stop' has been reached.
- .T.B Begin of sequence (or submethod).
- .T.F Final: End of determination (or submethod), the final steps will be carried out.
- .T.E Error. Message together with error number, see page 84ff.
- .T.H Hold: Status 'Hold' has been reached.
- .T.C Continue: Continue after hold.
- .T.O Conditioning OK: 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).  
 .T.EP EPList: Entry into EP list (with DET, MET, SET, KFT)  
 .T.RC Recalculation of results.

Messages for changes in the I/O lines. If the changes 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 Titrimo sends space (ASCII 32) and ! as an introducer. This is followed by the name of the device (see 3.2.2.96). Special ASCII characters in the device name are ignored. If no device name has been entered, only ! is sent. Finally the Titrimo sends the information which node has triggered the message.

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

|           |                                      |                           |
|-----------|--------------------------------------|---------------------------|
| 3.2.2.156 | <b>Setup.Graphics.Grid</b>           | <b>ON, OFF</b>            |
|           | <b>Setup.Graphics.Frame</b>          | <b>ON, OFF</b>            |
|           | <b>Setup.Graphics.Scale</b>          | <b>Full, Auto</b>         |
|           | <b>Setup.Graphics.Recorder.Right</b> | <b>0.2...0.5...1.00</b>   |
|           | <b>Setup.Graphics.Recorder.Feed</b>  | <b>0.01...0.05...1.00</b> |

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

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

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

.Scale: Type of scaling of the measured value axis:

Full means that the scale runs from the smallest up to the greatest measured point.

With auto, the smallest measured value is taken and the next smaller tick defines the beginning of the scale; the next greater tick to the greatest measured value is the end of the scale.

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

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

The settings can be made without a PC:

Press <configuration> key on switching on the instrument.

|           |                      |            |
|-----------|----------------------|------------|
| 3.2.2.157 | <b>Setup.PowerOn</b> | <b>\$G</b> |
|-----------|----------------------|------------|

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.

|           |                                |                                                           |
|-----------|--------------------------------|-----------------------------------------------------------|
| 3.2.2.158 | <b>Setup.Initialise</b>        | <b>\$G</b>                                                |
|           | <b>Setup.Initialise.Select</b> | <b>ActMeth, Silo, Calib, Config, Assembly, Setup, All</b> |

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.Initialise \$G.

3.2.2.159 **Setup.RamInit**

\$G

Initialises instrument as in the diagnosis, see page 176. 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.

3.2.2.160 **Setup.InstrNo**

\$G

**Setup.InstrNo.Value**

**serial number, 8 ASCII characters**

Instrument identification for report output.

Set the value with &Setup.InstrNo \$G .

### 3.3. Characteristics of the RS232 interface

#### 3.3.1 Data transfer protocol

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

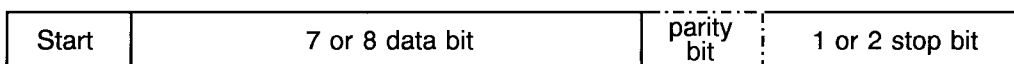
The RS232 interface has the following technical specifications:

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

Max. line length: 80 characters + C<sub>R</sub> L<sub>F</sub>

Control characters: C<sub>R</sub> (ASCII DEC 13)  
L<sub>F</sub> (ASCII DEC 10)  
XON (ASCII DEC 17)  
XOFF (ASCII DEC 19)

Cable length: max. ca. 15 m



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

#### 3.3.2 Handshake

##### 3.3.2.1 Software handshake , SWChar

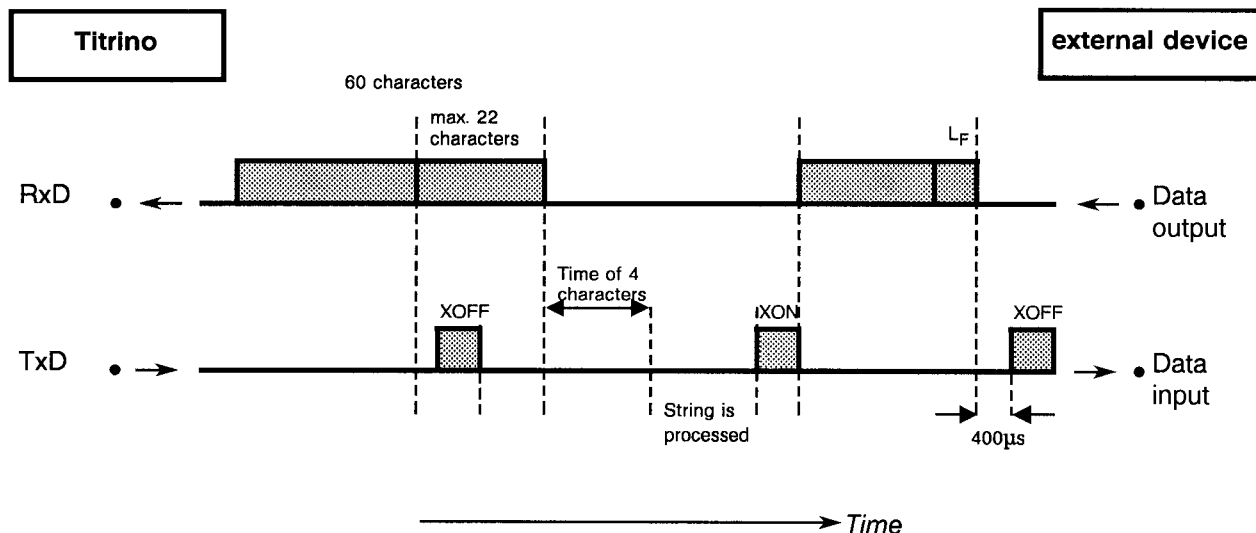
Handshake inputs at the Titrino (CTS, DSR, DCD) are not checked. Handshake outputs (DTR, RTS) are set by the Titrino.

As soon as a L<sub>F</sub> is recognised, the Titrino sends XOFF. It can then receive 6 extra characters and store them.

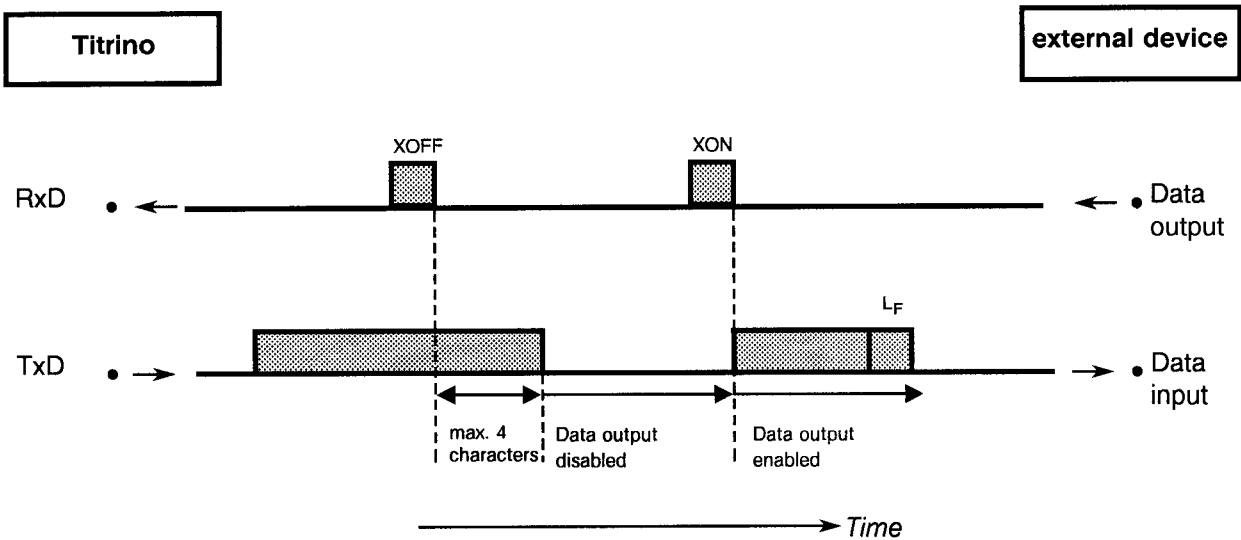
However, the Titrino also sends XOFF if its input buffer contains 60 characters. After this, it can receive maximum 22 extra characters (incl. L<sub>F</sub>).

If the transmission is interrupted for the time of 4 characters after the Titrino has sent XOFF, the string received earlier is processed even if no L<sub>F</sub> has been sent.

Titrino as receiver:



Titrimo as **sender**:

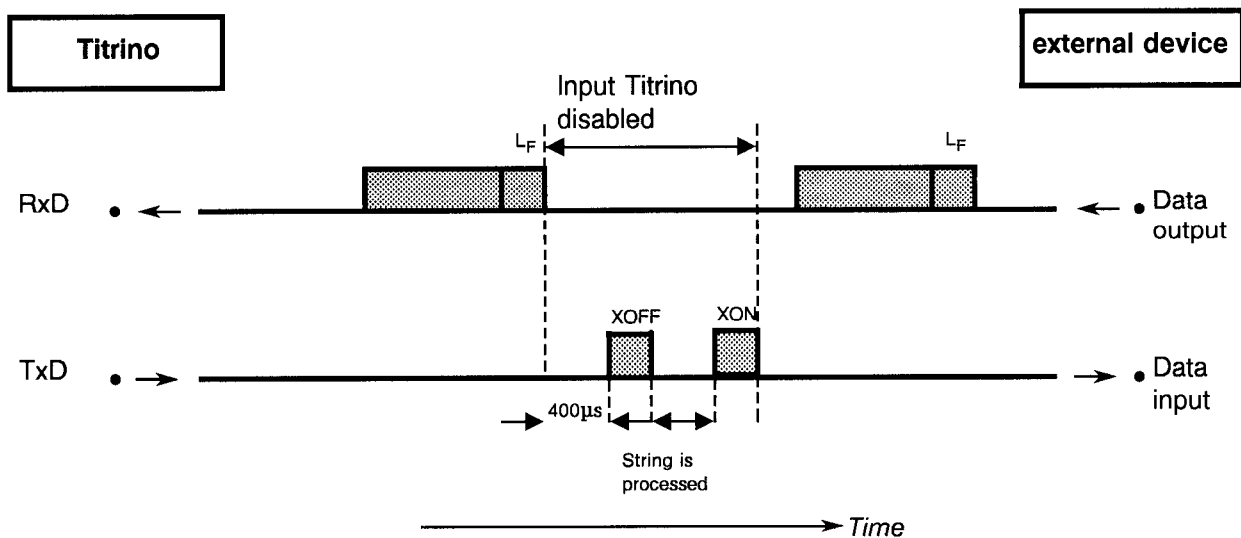


### 3.3.2.2 Software-Handshake , SWline

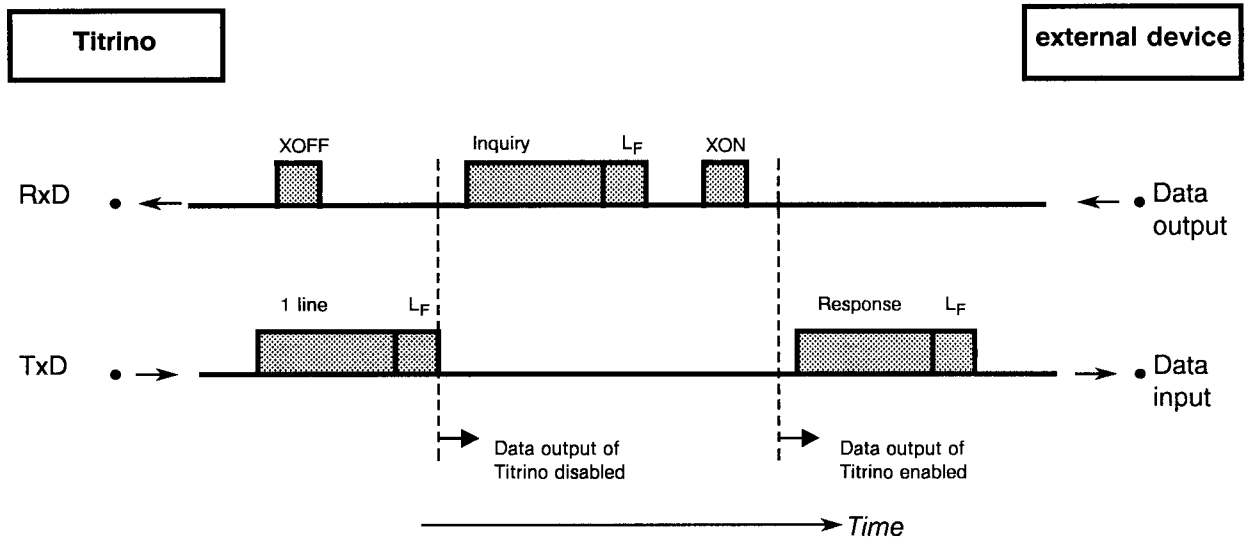
Handshake inputs at the Titrimo (CTS, DSR, DCD) are not checked.  
Handshake outputs (DTR, RTS) are set by the Titrimo.

The Titrimo is equipped with an input buffer that can accommodate a string of up to 80 characters +  $C_{R}L_F$ . As soon as an  $L_F$  is recognised, the Titrimo sends XOFF. After this, it can receive maximum 6 extra characters and store them. The string sent previously is now processed by the Titrimo. Afterwards, the Titrimo sends XON and is again ready to receive.

Titrimo as **receiver**:



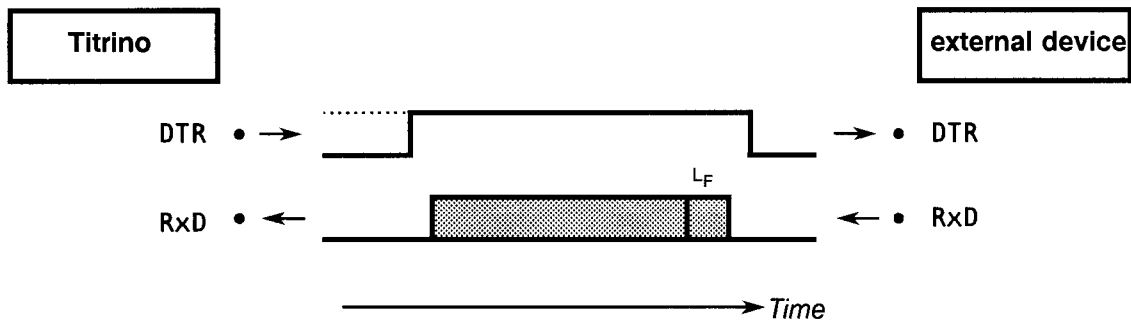
Titrimo as **sender**:



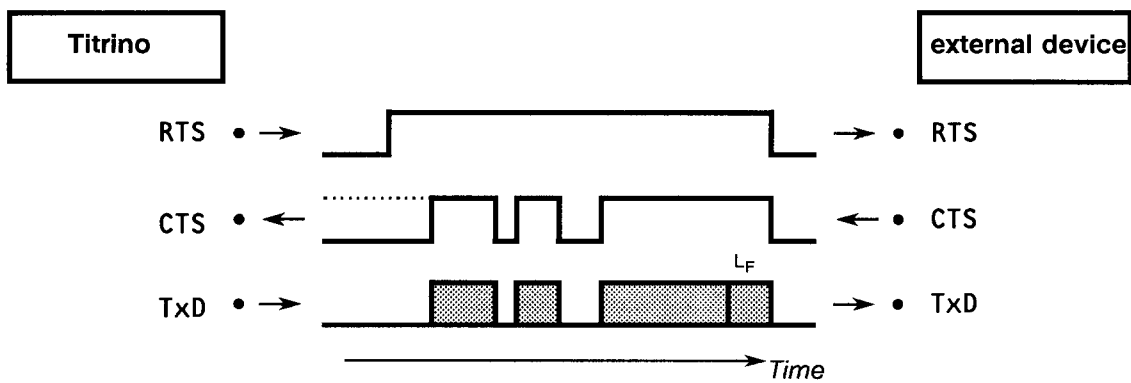
The transmission of the Titrimo can be stopped by the external device with XOFF. After receipt of XOFF, the Titrimo completes transmission of the line already started. If the data output is disabled for more than 3 s by XOFF, E43 appears in the display.

### 3.3.2.3 Hardware handshake, HWS

Titrimo as **receiver**:



Titrimo as **sender**:

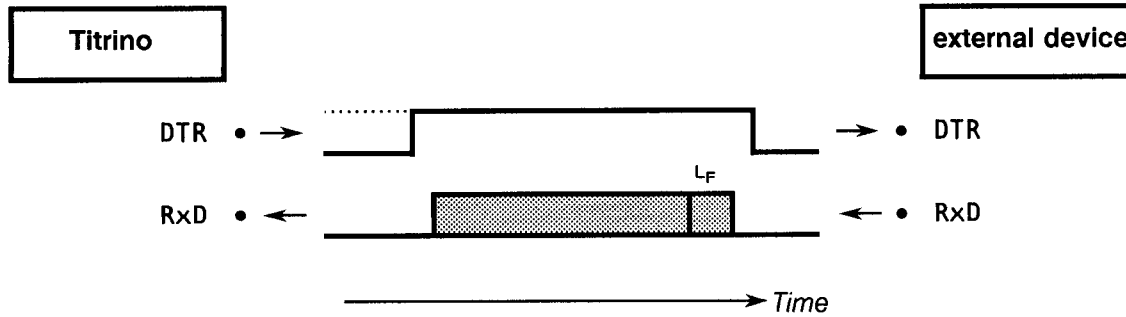


The data flow can be interrupted by deactivation of the CTS line.

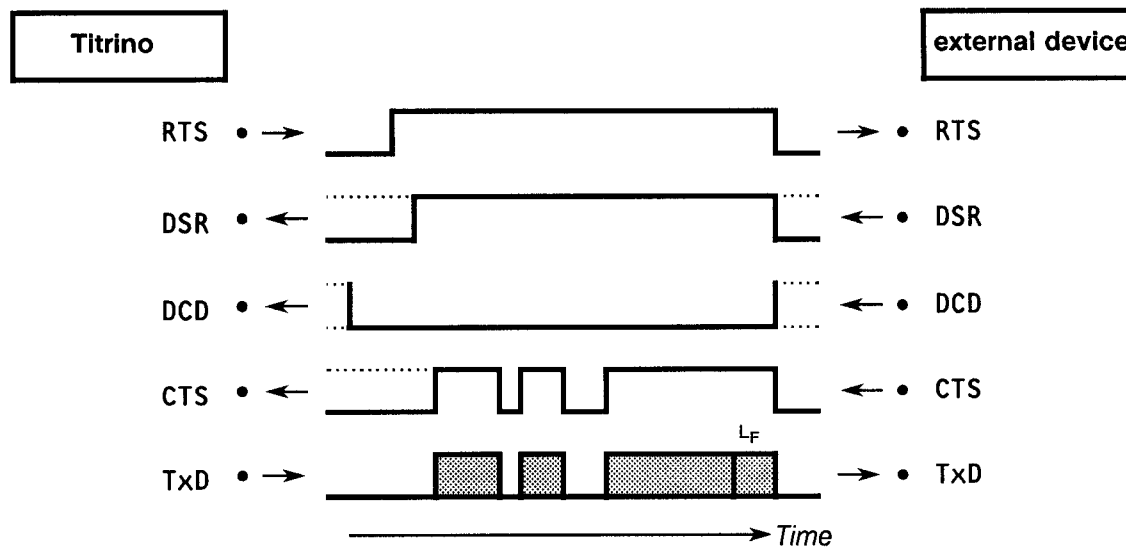
### Hardware handshake, HWf

All handshake inputs are checked at the Titrino, handshake outputs are set.

Titirino as receiver:



Titirino as sender:



The data flow can be interrupted by deactivation of the CTS line.

### 3.3.3 Pin assignment

|                                                                                                                                                                                                               |  | external                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------|
| <b>RS 232C Interface</b>                                                                                                                                                                                      |  |                             |
| <b>Transmitted data (TxD).</b><br>If no data are transmitted, the line is held in the "ON" condition. Data are transmitted only when CTS and DSR are in the "ON" condition and DCD is in the "OFF" condition. |  | E 2<br>Transmitted Data     |
| <b>Received data (RxD)</b><br>Data are received only when DCD is "ON".                                                                                                                                        |  | E 3<br>Received Data        |
| <b>Request to Send (RTS)</b><br>ON condition: Titirino is ready to send data.                                                                                                                                 |  | E 4<br>Request to Send      |
| <b>Clear to Send (CTS)</b><br>ON condition: Remote station is ready to receive data.                                                                                                                          |  | E 5<br>Clear to Send        |
| <b>Data Set Ready (DSR)</b><br>ON condition: The transmission line is connected.                                                                                                                              |  | E 6<br>Data Set Ready       |
| <b>Signal Ground (GND)</b>                                                                                                                                                                                    |  | E 7<br>Signal Ground        |
| <b>Data Carrier Detect (DCD)</b><br>ON condition: The level of the received signal is within the tolerance range (remote station is ready to send data).                                                      |  | E 8<br>Data Carrier Detect  |
| <b>Data Terminal Ready (DTR)</b><br>ON condition: Titirino is ready to receive data.                                                                                                                          |  | E 20<br>Data Terminal Ready |



### 3.4 What can you do if the data transfer does not work?

| Problem                                                                           | Questions for remedial action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No characters can be received on a connected printer                              | <ul style="list-style-type: none"> <li>- Are the instruments and the connection cables plugged in properly?</li> <li>- Is the printer set to "on-line"?</li> <li>- Are baud rate, data bit and parity settings the same for both devices?</li> <li>- Is the handshake set properly?</li> </ul> <p>If everything appears to be in order, try to print out a report with the key sequence &lt;print&gt; &lt;smpl data&gt; &lt;enter&gt;. If this report is printed out correctly, check whether under the key &lt;def&gt;, &gt;report a report is preselected.</p> |
| No data transmission occurs and the display of the Titrino shows an error message | <ul style="list-style-type: none"> <li>- <b>E40-42:</b> Transmission error. Is the cable used properly wired and connected? Is the printer switched on and set to "on-line"?</li> <li>- <b>E43:</b> Data output of the Titrino disabled for longer than 3 s by XOFF.</li> <li>- <b>E36-39:</b> Receive error. Are the settings of the RS232 data transmission parameters the same for both devices?</li> </ul>                                                                                                                                                   |
| The received characters are garbled                                               | <ul style="list-style-type: none"> <li>- Are the data bit and the parity settings the same for both devices?</li> <li>- Is the baud rate setting the same for both devices?</li> <li>- Has the correct printer been selected?</li> <li>- Data transfer has been interrupted on the hardware side during the printout of a curve. Re-establish connections and switch printer off/on.</li> </ul>                                                                                                                                                                  |
| Wrong line spacing                                                                | <p>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).</p>                                                                                                                                                                                                                                                                                                                                                                                                |
| Printout of titration curve is not ok. Other reports are printed ok               | <p>Handshake is necessary for the printout of a titration curve.</p> <ul style="list-style-type: none"> <li>- Is your cable correctly wired? (The DTR of the printer has to be connected to the CTS of the 736 GP Titrino.)</li> <li>- Set "HWs" for the handshake at the 736 GP Titrino. Configure the printer such that its DTR is set (normally with DIP switches).</li> </ul>                                                                                                                                                                                |

## 4. Error messages, Troubleshooting

|                                |                                                                                                                                                                           |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| "Ticking" of the Exchange Unit | Cause: Stopcock switch mechanism bouncing.<br>Press the stopcock switch lever manually into the end position. Do not rotate the stopcock when the Titrino is switched on! |
| Data transfer inoperative      | See measures on page 161.                                                                                                                                                 |

### 4.1 Error and special messages

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>XXX bytes missing</b>        | 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.<br>Remedy: <QUIT>. Delete methods no longer needed or use fewer silo lines.                                                                                                                                                                                                                                                                      |
| <b>card battery low</b>         | The battery tension is between 2.37...2.64 V.<br>Remedy: <clear> and change battery as soon as possible.                                                                                                                                                                                                                                                                                                                                                                              |
| <b>card busy</b>                | The memory card is busy.                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>card not accessible</b>      | The card is not accessible because it is used by the RS interface or a card report is prepared.                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>card read/write error</b>    | Working with the card a read/write error appeared.<br>Remedy: <clear> or insert a different card.                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>card unformatted</b>         | Remedy: <clear> and format the card.                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>card write-protected</b>     | Writing functions are not possible, if the card is write-protected.<br>Remedy: <QUIT> and remove write protection, i.e. push write protection to the left.                                                                                                                                                                                                                                                                                                                            |
| <b>change card battery</b>      | The date for changing the battery is expired.<br>Remedy: <clear>, change the card battery and enter a new battery change date.                                                                                                                                                                                                                                                                                                                                                        |
| <b>check drive unit!</b>        | The buret is not connected (correctly) or defect.<br>Remedy: Rectify fault or <STOP>.                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>check electrode</b>          | With polarized electrodes. There is a break or short circuit. Possible causes and rectification of the fault:<br>– the electrode is not plugged in → plug it in<br>– the electrode is not immersed in the solution → immerse it<br>– the electrode is defective → use new electrode.<br>– the electrode cable is defective → use new cable.<br>The electrode test can be switched off under the <parameters> key, , see pages 23, 31, 42, 49 or 54.<br>Exit: Rectify fault or <STOP>. |
| <b>check exchange unit</b>      | The Exchange Unit is not mounted (properly).<br>Exit: Mount Exchange Unit (properly) so that the coupling engages or <STOP>.                                                                                                                                                                                                                                                                                                                                                          |
| <b>check T-sensor</b>           | No temperature sensor is attached (with MEAS T or if the temperature monitoring is active).<br>Exit: Connect Pt100 or Pt1000 or <STOP>.                                                                                                                                                                                                                                                                                                                                               |
| <b>DX ↑ / ↔ overload</b>        | The motor of dosing drive X has reached its current limit because the piston or the cock doesn't move.<br>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.                                                                                                                                                                                                                            |
| <b>data lost</b>                | The data of the memory card are lost as the battery tension was lower than 2.37 V<br>Exit: <clear>.                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>data set reevaluation</b>    | Message if Titrino is reevaluating downloaded measuring point lists.                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>directory already exists</b> | The directory exists already.<br>Remedy: <QUIT> and enter a different directory name or delete the directory with the same name.                                                                                                                                                                                                                                                                                                                                                      |

|                                |                                                                                                                                                                                                              |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>division by zero</b>        | The result could not be calculated as a divisor in the formula was equal to zero.<br>Exit: Enter appropriate value.                                                                                          |
| <b>EP overflow</b>             | In a DET or MET titration 9 EP's or more were found. The first 9 EP's will be listed.<br>Remedy: Recalculation of data with higher EP criterion.                                                             |
| <b>limit</b>                   | Message in the measuring point list: More than one limit value of the activated monitoring functions has been violated.                                                                                      |
| <b>manual stop</b>             | The determination has been manually stopped.                                                                                                                                                                 |
| <b>meas out of limit</b>       | The determination has been stopped as a limit value of the measured value monitoring has been violated.                                                                                                      |
| <b>meas.lim</b>                | Message in the measuring point list: A limit value of the measured value monitoring has been violated.                                                                                                       |
| <b>meas.pt list overflow</b>   | Maximum 500 measured points can be stored.<br>Exit: Use start criteria or select larger time interval.                                                                                                       |
| <b>missing EP</b>              | An EP needed for calculation in a formula is missing.                                                                                                                                                        |
| <b>missing fix EP</b>          | A fix EP needed for calculation in a formula is missing.                                                                                                                                                     |
| <b>missing fix time</b>        | A fix time C6X needed for calculation in a formula is missing.                                                                                                                                               |
| <b>missing fix V</b>           | A fix V C5X needed for calculation in a formula is missing.                                                                                                                                                  |
| <b>missing rate</b>            | A rate C8X needed for calculation in a formula is missing.                                                                                                                                                   |
| <b>no end set</b>              | With DOC the end of the ramp has not been set.<br>Exit: <STOP> and set end.                                                                                                                                  |
| <b>no.EP not corresponding</b> | 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.                                                                      |
| <b>no EP set</b>               | In SET or STAT, no EP has been set.<br>Exit: <STOP> and set EP.                                                                                                                                              |
| <b>no memory card</b>          | The memory card is not inserted (correctly).<br>Remedy: <clear> or rectify fault.                                                                                                                            |
| <b>no meas.quantity</b>        | In DOS or TIP a manual measurement (<meas/hold>) has been performed without defining a measuring quantity.<br>Exit: <meas/hold> and define measured quantity.                                                |
| <b>no memory card</b>          | The card is not connected (correctly).<br>Exit: <clear> or rectify fault.                                                                                                                                    |
| <b>no method</b>               | The method required by the sample data from the silo memory or in a TIP sequence is not available in the method memory.<br>Exit: <clear>.                                                                    |
| <b>no new com.var.</b>         | The common variable could not be assigned as the result or the mean value could not be calculated. The old value remains in force.                                                                           |
| <b>no new mean</b>             | No new mean value has been calculated as at least one quantity stipulated for mean value calculations could not be calculated.                                                                               |
| <b>no new silo result</b>      | No new silo result C24 or C25 could be stored as the assigned quantity could not be calculated.                                                                                                              |
| <b>no new temp.var.</b>        | No new temporary variable C7X could be stored as the assigned quantity could not be calculated.                                                                                                              |
| <b>no sequence</b>             | No sequence is defined in TIP.<br>Exit: <clear> and define sequence.                                                                                                                                         |
| <b>no titration data</b>       | No curve can be printed as no data are available.<br>With the curves measured value vs. time or temperature vs. time, the corresponding monitoring function must be on for the recording of measured points. |
| <b>not possible</b>            | Writing functions on the card 6.6023.XXX are not possible or the function "empty" cannot be executed with a Dosimat.                                                                                         |
| <b>not valid</b>               | A value is not available.                                                                                                                                                                                    |
| <b>outside</b>                 | The set fix volume, a fix EP or fix time is outside the measuring range.                                                                                                                                     |

|                                   |                                                                                                                                                                                                                                                                                     |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>overrange</b>                  | The measuring range of $\pm 2$ 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. |
| <b>prep.internal D0!</b>          | Warning that the preparation for the internal buret D0 has to be executed (the warning interval is run-off).<br>Exit: Execute preparation with <START> or ignore warning with <clear>.                                                                                              |
| <b>prep.external DX!</b>          | Warning that the preparation for the external buret DX has to be executed (the warning interval is run-off).<br>Exit: Execute preparation with <START> or ignore warning with <clear>.                                                                                              |
| <b>prep: manual stop rate lim</b> | The preparation or emptying of the buret was stopped with <STOP> .<br>Message in the measuring point list. A limit value of the rate monitoring has been violated.                                                                                                                  |
| <b>rate out of limit</b>          | The determination has been stopped as a limit value of the rate monitoring has been violated.                                                                                                                                                                                       |
| <b>rate too high</b>              | With DOS the calculated rate is too high. It can not be achieved with the mounted Exchange Unit.<br>Exit: <clear> and use Exchange Unit with larger buret volume or change dosing conditions.                                                                                       |
| <b>rate too low</b>               | With DOS the calculated rate is too low. It can not be achieved with the mounted Exchange Unit.<br>Exit: <clear> and use Exchange Unit with smaller buret volume or change dosing conditions.                                                                                       |
| <b>rates not corresponding</b>    | 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.                                                                           |
| <b>same buffer</b>                | In the calibration sequence the voltage difference between the first and second buffer is < 6 mV.<br>Exit: <quit> and change buffer or <STOP> (abort calibration).                                                                                                                  |
| <b>save lines OFF</b>             | The function "save lines" is not active although a submethod of TIP contains assignments to C24 or C25.<br>Exit: <clear> and switch on "save lines" under <smpl data> key.<br><b>Warning:</b> The results of this line will not be saved.                                           |
| <b>second TIP call</b>            | In TIP no further TIP can be called up as a submethod.<br>Exit: <clear> and define new sequence.                                                                                                                                                                                    |
| <b>silos empty</b>                | The silo memory is switched in and empty and a titration has been started. Corrective action: At least the first 1 silo line before starting the first titration.<br>Exit: <clear> .                                                                                                |
| <b>silos full</b>                 | The silo memory is full up.<br>Corrective action: If you have filled less than 99 silo lines, you can create more space by deleting old methods no longer needed. 1 silo line needs 18...120 bytes.<br>Exit: <clear> .                                                              |
| <b>stop EP reached</b>            | A DET or MET titration was stopped as the stop criterion "stop EP" was reached.                                                                                                                                                                                                     |
| <b>stop meas.val.reached</b>      | A DET or MET titration was stopped as the stop measuring value pH, U or I was reached.                                                                                                                                                                                              |
| <b>stop rate reached</b>          | STAT has been stopped as the stop rate has been reached.                                                                                                                                                                                                                            |
| <b>stop time reached</b>          | SET or STAT has been stopped as the stop time has been reached.                                                                                                                                                                                                                     |
| <b>stop V reached</b>             | The determination has been stopped as the stop volume has been reached.                                                                                                                                                                                                             |
| <b>system error 3</b>             | The instrument adjustment data have been overwritten.<br>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).                                                         |

|                          |                                                                                                                                |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>temp out of limit</b> | The determination has been stopped as a limit value of the temperature monitoring has been violated.                           |
| <b>temp.lim</b>          | Message in the measuring point list: A limit value of the temperature monitoring has been violated.                            |
| <b>TIP terminated</b>    | TIP has been terminated.                                                                                                       |
| <b>wrong card</b>        | The memory card is from an other apparatus or the card was inserted/removed during an operation with <card> .<br>Exit: <clear> |
| <b>wrong sample</b>      | 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:

|            |          |   |                                                                          |
|------------|----------|---|--------------------------------------------------------------------------|
| <b>E36</b> | Parity   | } | Exit: <QUIT> and set corresponding quantity the same on both instruments |
| <b>E37</b> | Stop bit |   |                                                                          |

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

**E39**            Overflow of the receive buffer of the GP Titrimo (> 82 characters).  
Exit:    <QUIT>

Send errors:

|            |           |   |                                                                   |
|------------|-----------|---|-------------------------------------------------------------------|
| <b>E40</b> | DSR = OFF | } | Exit: <QUIT><br>Is the receiver switched on and ready to receive? |
| <b>E41</b> | DCD = ON  |   |                                                                   |
| <b>E42</b> | CTS = OFF |   |                                                                   |

**E43**            The transmission of the GP Titrimo has been interrupted with XOFF for at least 3 s.  
Exit:    <QUIT> .

**E44**            The RS interface parameters are no longer the same for both instruments.

**E45**            The receive buffer of the Titrimo contains an incomplete string (missing L<sub>F</sub>).  
Transmission of the Titrimo is thus blocked.  
Exit:    Send L<sub>F</sub> or <QUIT> .

## 4.2 Diagnosis (for 5.736.001X Program)

The GP Titrino is a very precise and reliable instrument. Thanks to its rugged construction it is virtually impossible for external mechanical or electrical influences to have an adverse effect on its functions.

Although the occasional fault in the instrument can not be excluded completely, it is certainly much more likely that malfunctions are caused by wrong operation or handling or through improper connections and operation with non-Metrohm instruments.

It is thus advisable in each case to isolate the fault with the rapid and easy to perform diagnostic tests. The customer thus need not call METROHM service until there is a true fault in the instrument. In addition, with the aid of the numbering in the diagnostic program he can provide the service engineer with much more accurate information.

In inquiries always quote the manufacturing (page 3) and program number (see configuration, page 8) and specify possible error displays.

### Procedure

- The diagnostic steps must be performed in sequence and compared with the reactions of the 736 GP Titrino (indented). In the "yes" case, continue with the next instruction.
- If the instrument does not show the expected reaction ("no" case), the appropriate diagnostic step must be repeated to exclude an operating error. With repeated wrong reactions, however, there is a strong possibility that a malfunction exists.
- The diagnostic steps marked with a triangle ( $\triangleright$ ) allow re-entry into the test routine for repetition if the following display appears:

**diagnose press key 0...9**

If the instrument is in a subprogram of the diagnostic routine: Press the <clear> key.

If need be, switch the power off then on again after a few seconds. At the same time press key "9" until the above display appears.

- If the <clear> key is pressed during the display of 'diagnose press key 0...9', the instrument jumps back into the user program.
- Error display: An error is shown in the display as follows:

**error XX**

|  
error number

- If a fault causes the burette drive to stick at the top or bottom end of the cylinder, see point 15, page 177.

**Equipment required:**

- voltage calibrator, e.g. Metrohm pH Simulator 642<sup>1</sup>
- Highly insulated interconnection cable 6.2108.060
- Resistor switch-box, class 0.1% (or resistor 14.3 k 0.1%)
- 3.496.5070 Cable<sup>2</sup>
- Exchange Units, if possible with different cylinder volumes (or 3.496.0070 Dummy Exchange Unit)
- Stop watch or watch with second hand
- 6.2132.050 Keypad
- Digital or analog voltmeter (if need be, connect a calibrated recorder)  
(2 connecting cables with 4 mm banana plugs)

Necessary only if external functions should also be checked:

- 3.496.8510 Test Plug (at 'Remote' connector)
- 3.496.8480 Test Plug (at 'RS 232' connector)

➤ 1. **Prepare instruments for diagnostic test**

Power off

Disconnect all external connections (cables at rear) except mains cable and keypad.

Remove Exchange Unit

Power on and immediately press and hold the <9> key until the powerup test pattern disappears.



diagnose press key 0...9

➤ 2. **Perform display test**

Press <2>



display test

Press <enter>.

After the <enter> key has been pressed, characters for a visual check of the display are generated on both lines.

Test sequence:

- Display is cleared and overwritten from the left with a dot pattern.
- Display is cleared and both lines are written into with the letters A, B, C...Z.
- The complete character set (see Fig. 4-1) is shown as a moving display. At the same time with the moving display, the LED lamps 'statistics' and 'silo' are switched on and off.

The test sequence can be held at any time with the <5> key and then continued.

Block 2 is quit with the <clear> key.

1 If no suitable voltage calibrator is available: Use any stable voltage source and connect a precise DVM in parallel.

2 If no suitable cable is available: Remove indicator electrode from cell. Connect switch-box or resistor combination with laboratory cable and test clips carefully to the platinum wires of the indicator electrode.  
(Warning: Do not bend platinum wire!)

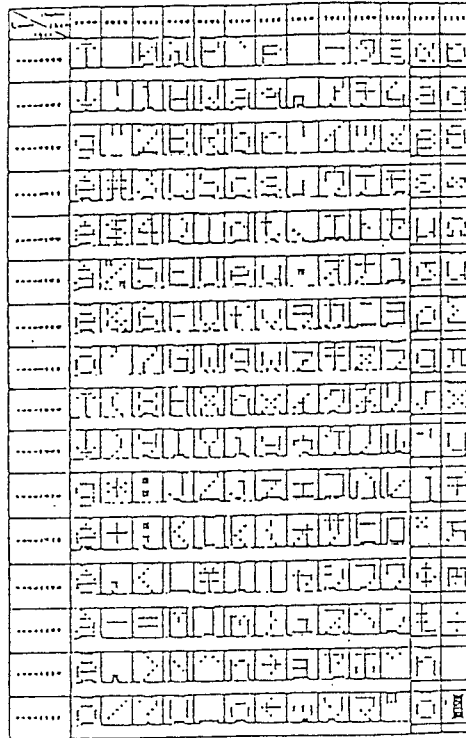


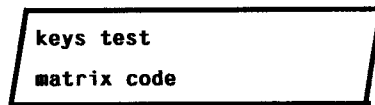
Fig. 4-1:  
Character set

» 3. Keypad test

Press <1>



Press <enter>



If any key is now pressed (on the 6.2132.050 Keypad or on the front panel of the 736), the appropriate matrix code appears in the display (0...31).

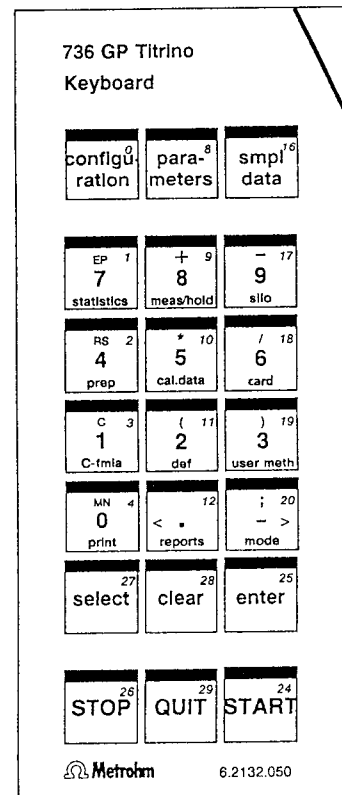
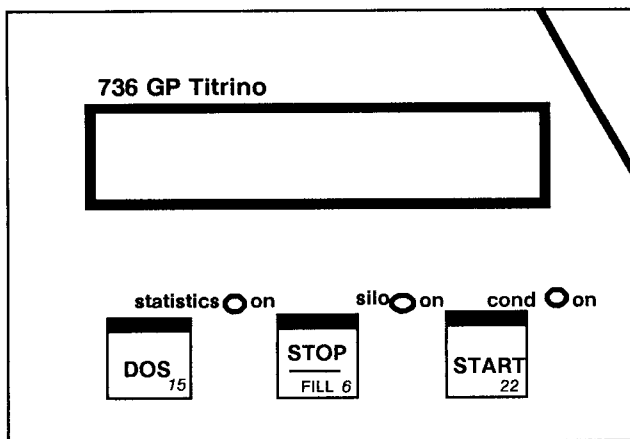


Fig. 4-2 Matrix code table

Block 1 is quit by pressing the <clear> key twice.

➤ 4. **Cylinder code, date, time**

Press <0>

```
date/time
cylinder code
```

Press <enter>

```
date XX-XX-XX1 XX:XX:272
check exchange unit
```

Check date and time. If deviations are found, enter new date and/or time, see page 8.

Insert Exchange Unit (or dummy)

```
date XX-XX-XX1 XX:XX:XX2
code:          XX ml3
```

*For the sake of completeness, different Exchange Units can be inserted to verify their ml code.*

If desired, the Exchange Unit can be removed again.

Press <clear>

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

➤ 5. **Check analog output**

*A voltage can be set at the analog output (sockets at D) using the keypad. But this should not exceed  $\pm 2000$  mV. This voltage can also be used for the calibration of a connected recorder.*

Connect a voltage measuring instrument (voltmeter, DVM, recorder) to the analogue output (14)

Press key <3>

```
analog output-1 test
```

<enter>

```
analog output-1 test
V-out =      XX4 mV
```

Enter a voltage value in the range ( $\pm$ )2000 mV using the keypad. After the <enter> key has been pressed, this value appears as a voltage at the analog output.

Read off value on the connected voltmeter and compare with the mV value on the display. (Tolerance  $\pm 2$  mV)

Exit: <QUIT>

Disconnect voltmeter.

- 1 acurrent date
- 2 current time
- 3 Check that mL code of Exchange unit used is displayed
- 4 This value is incidental, but can be accepted with <enter>.

➤ 6. **Motortimertest**

<6>

motor-timer test

<enter>

pot.meter dV/dt → 10 ?

Turn knob 'dV/dt' to the right stop

<enter>

motor-timer test

Test sequence

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

After ca. 3 s, the text 'o.k.' appears in the display.

<clear>

diagnose press key 0...9

➤ 7. **Analog input test**

Press <7>

analog input test 1...5

7.1 **Examination of highly insulated measuring inputs**

Connect 'Ind I' measuring input (11) to a voltage calibrator (e.g. Metrohm 642 pH simulator) by means of a highly insulated cable (e.g. 6.2108.060). Set calibrator to 0 V.

<1>

Input 1            0.0 mV

Tolerance:  $\pm 0.5$  mV

Set the calibrator voltage, on setting 'low ohmic' (with 642 =  $\sim 0.002$  M $\Omega$ ), to different values (e.g. + 1500 mV) and compare with the displayed value.

Tolerance (with  $\pm 1500 \div 2000$  mV)  $\pm 1$  mV

*(Be aware of the calibrator's tolerance.)*

Set simulator to high ohmic condition (with 642 = 1000 M $\Omega$ ).

The displayed reading may vary slightly only (with 1500 mV  $\leq 1$  mV)

<clear>

analog input test 1...5

Disconnect simulator from 'Ind I' input and connect to 'Ind II' input (11):

<2>

Input 2                    XX mV

Carry out the same measurements as with Input I and compare the displayed value.

<clear>

analog input test 1...5

Short-circuit input 'Ind I' (e.g. with cable 3.496.5070)

<3>

Input 1-2                    XX mV

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

Example:  $0 - (+)1500 \text{ mV} = -1500 \text{ mV}$

<clear>

analog input test 1...5

## 7.2 To check Pt 100 / 1000 connection

Connect a Pt 100 or Pt 1000 sensor, a resistor switch-box or a single resistor of  $100 \Omega$  or  $1 \text{ k}\Omega$ , respectively, to sockets 'Pt 100/1000' (12) by means of short cables.

<4>

Pt 100\*                    XX °C

(\* oder Pt 1000)

Tolerance:  $\pm 0.5 \text{ }^\circ\text{C}$

*(Note also tolerance of resistor switch-box.)*

The sensor allows automatic displaying of the room temperature. (The resistances correspond to  $0 \text{ }^\circ\text{C}$ .)

<clear>

analog input test 1...5

Remove resistor switch-box.

**7.3 Polarizer test**

Press <5>

**Polarizer test**

<enter>

**dummy resistor 14.3 kΩ ?**

Connect resistor switch-box (or suitable resistor 14.3 k /0.1%) using 3.496.5070 Cable<sup>3</sup> to 'Pol' socket(10). Switch-box to 14.3 k.

<enter>

**polarizer test**

— An asterisk flashes during the test

The test runs automatically. If no error is found, after about 15 s 'polarizer test o.k' appears. If not, an error message appears. (If the switch-box is not connected, Error 100 appears.)

*In case of an error: depress <clear> several times until all error numbers are indicated.*

<clear>

**analog input test 1...5**

<clear>

**diagnose press key 0...9**

Remove cable and resistor switch-box.

➤ **8. External inputs and outputs**

*This test is meaningful only if the 736 GP Titrimo is used interconnected with other instruments via the 'Remote' connection. In addition, a 3.496.8510 Test Plug normally used in the repair service is required for this test. However, this plug can also be purchased by customers under the above number. For the sake of completeness, the procedure is described here. (If a diagnostic test of the external inputs and outputs is not required, continue with point 9.)*

| Plug 3.496.8510 |     |        |     |
|-----------------|-----|--------|-----|
| PIN             | PIN | PIN    | PIN |
| 1 ———           | 24  | 5 ———  | 21  |
| 2 ———           | 12  | 9 ———  | 18  |
| 3 ———           | 23  | 10 ——— | 17  |
| 3 ———           | 22  | 11 ——— | 16  |

Fig. 4-3 Connections in the 3.496.8510 Test Plug

Press key <4>

**extern input/output test**

<sup>3</sup> If cable not available see page 135.

<enter>

**I/O-test-connector?**

Insert the 3.496.8510 Test Plug in port B 'Remote' (9) (do not switch off instrument, pay attention to alignment of the plug!).

<enter>

*The test runs automatically. If no error is found, 'extern input/output o.k.' appears. Otherwise, an error message is displayed. If no test plug is connected, 'error 50 01 HEX' appears.*

Remove test plug

<clear>

**diagnose press key 0...9**

➤ 9. **RS 232 Test**

*This test is meaningful only if the GP Titrino 736 is used interconnected with other instruments via the 'RS 232' connection. In addition, a 3.496.8480 Test Plug normally used in the repair service is required for this test. However, this plug can also be purchased by customers under the above number.*

*For the sake of completeness, the procedure is described here.*

*(If a diagnostic test of the RS232 interface is not required, continue with point 10.)*

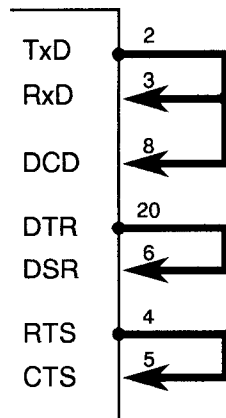


Fig. 4-4 Connections in the 3.496.8480 Plug

Press key <5>

**RS232 test**

<enter>

**RS232 test-connector?**

Insert 3.496.8480 Plug in 'RS 232' port (do not switch off instrument, pay attention to alignment of the plug!).

<enter>

*The test runs automatically. If no error is found, 'RS 232 test o.k.' appears after ca. 3 s. Otherwise, an error message is shown. If no test plug is connected, 'error 68' appears.*

Remove test plug

<clear>

diagnose press key 0...9

➤ 10. Memory card test

<9>

memory card test

Insert memory card.

<enter>

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

memory card 128 KB o.k.

<clear>

diagnose press key 0...9

➤ 11. Internal dosing unit D 0

<clear>

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

XXX X      YY \*\*\*\*\*

X = according to the selected method  
Y = according to the selected dosing unit

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 96).

Set the parameters of this function accord. to the following list (for setting the parameters see page -9-).

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 D0    max. ml/min  
fill rate D0    max. ml/min

Insert exchange unit.

<prep>

internal D0            prep

<START>

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

Remove exchange unit.



## 12. External dosing units D 1 or D 2

This test makes sense only when the 736 GP 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 96).

Set the parameters of this function accord. to the following list (for setting the parameters see page -9-).

Connect the external dosint units D 1 or D 2 respectively.

### Parameters for 700 Dosino

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

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 DXmax. ml/min

Press <prep> several times, until

external D1: prep

or

external D2: prep

<START>

The external dosing unit executes the following jobs:

- To expell the total volume
- to fill the filling tube
- to fill the cylinder
- to fill the dosing tube.

## 13. Setting up original arrangement

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

## ➤ 14. Initialise and test RAM

On the odd occasion large disturbing signals (e.g. mains spikes, lightning, etc.) can have an adverse effect on the processor functions and hence lead to a system crash. After such a crash the RAM area must be initialised. Although the basic instrument data remain stored, the RAM initialisation should be performed only when necessary since the stored user data (configuration, parameters, calculation variables, etc.) are cleared as a result.

Perform point 1 of the diagnostic routine.

diagnose press key 0...9

Press <8>

RAM init.

<enter>

RAM init. passed

RAM is tested and initialised.

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

Perform point 11.

If 'system error 3' appears in the display, <clear> can be used to exit to the instrument program. The initialisation values are loaded automatically. The instrument thus remains capable of measurement. However, possibly a small loss in accuracy must be anticipated. A new optimum adjustment can be performed by Metrohm service. The error message 'system error 3' always appears after the instrument is switched on until this adjustment has been performed.

➤ 15. **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 be removed. In this case, it is necessary to proceed as follows:

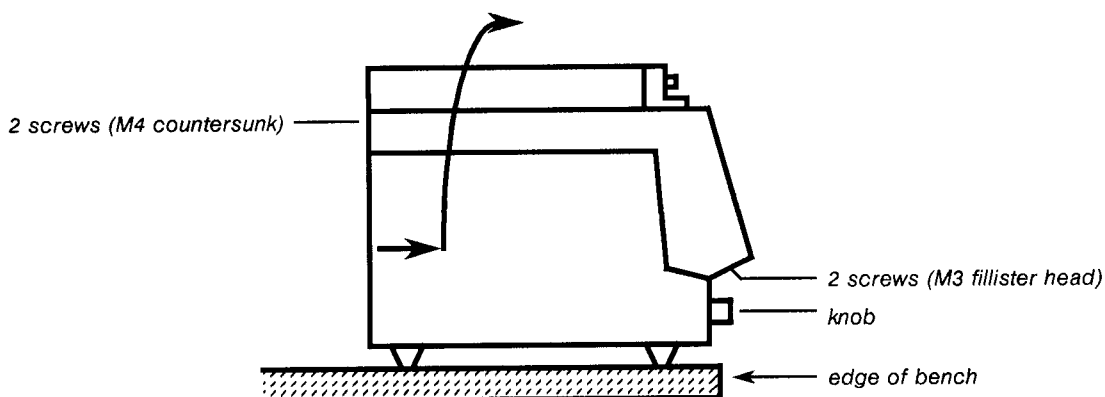


Fig. 4-6

- Disconnect instrument from power supply!
- Remove control knob
- Place instrument over edge of bench to allow the M3 screws to be removed (Fig. 4-6)
- Remove M4 screws
- Lift off top part of instrument together with Exchange Unit in the manner shown by the arrow



**The electronic circuits are now accessible!!  
On no account touch these!**

- Remove spindle from mechanical stop by turning the large gear wheel. (In case that the motor is inoperative, position spindle by hand to zero position.)

## Overview of the key assignment in the diagnostic tests

via key <9> with power on→

**diagnose press key 0...9**

For repeat observations and special applications, it may be an advantage to enter a particular check directly. In what follows, the numeric assignment is thus given.

|       |                                                      | page | point |
|-------|------------------------------------------------------|------|-------|
| Key 0 | Display of date and time and the cylinder code ..... | 169  | 4     |
| Key 1 | Keypad test .....                                    | 168  | 3     |
| Key 2 | Display test .....                                   | 167  | 2     |
| Key 3 | Analog output test .....                             | 169  | 5     |
| Key 4 | External input/output test .....                     | 172  | 8     |
| Key 5 | RS232 interface test .....                           | 173  | 9     |
| Key 6 | Motor timer test .....                               | 170  | 6     |
| Key 7 | Polarizer test .....                                 | 170  | 7     |
| Key 8 | Test and initialise RAM .....                        | 176  | 12    |
| Key 9 | Memory card test .....                               | 174  | 10    |

# 5. Preparations

Ensure that the set operating voltage corresponds to the mains voltage before switching on the instrument.

The mains cables supplied with the instrument are three-core and equipped with a plug with an earthing pin. If a different plug has to be fitted, the yellow/green lead must be connected to the protective earth. If no socket with earthing is available, the instrument must be connected to a perfect earthing conductor via its earthing socket. Each break in the earthing inside or outside the instrument can make it a hazard.

When the instrument is opened or if parts of it are removed, certain components may be live if the instrument is connected to the mains. The mains cable must therefore always be unplugged when certain adjustments are made or parts replaced.

## 5.1 Setting up and connecting the instruments

### 5.1.1 Titrino with Magnetic Stirrer

The instruments are set up and connected as shown in Fig. 5-1.

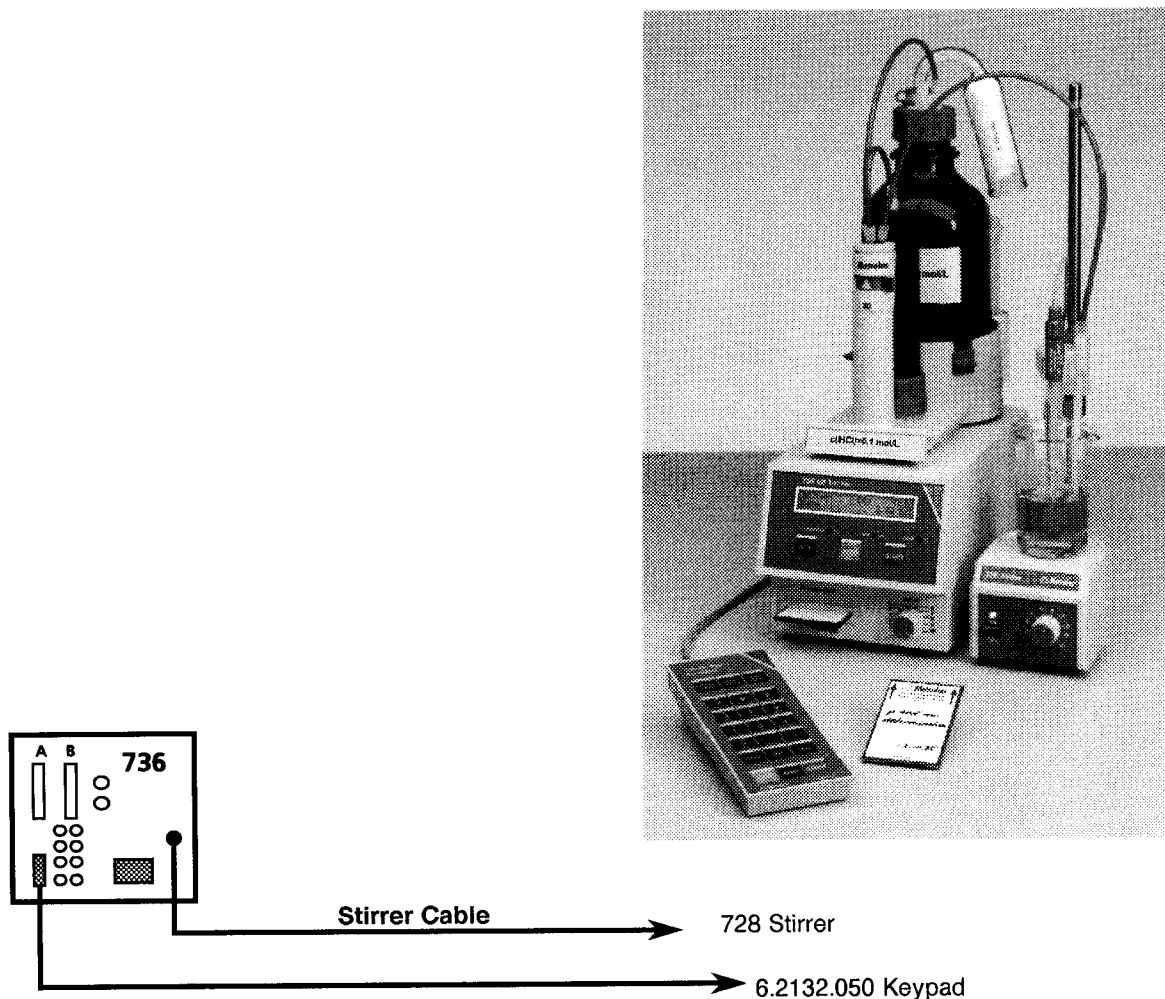


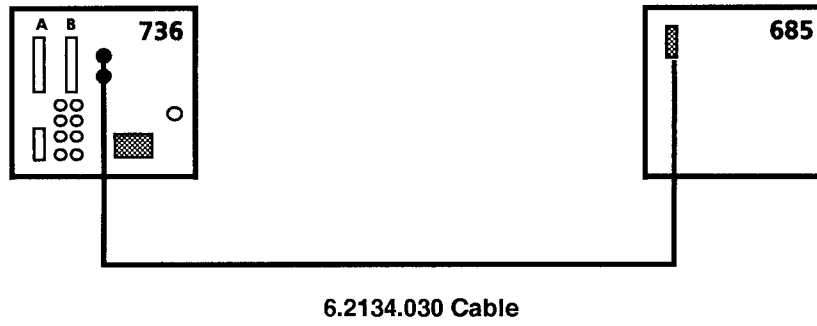
Fig. 5-1: Setting up the GP Titrino and connection of the stirrer

The 722 Rod Stirrer, the 727, or the 703 Ti Stand with 6.2108.100 cable can also be connected instead of the 728 Magnetic Stirrer.

### 5.1.2 Titrino with external burets

The instruments are connected according to Fig. 5-2.

**685 Dosimat:**



**700 Dosino:**

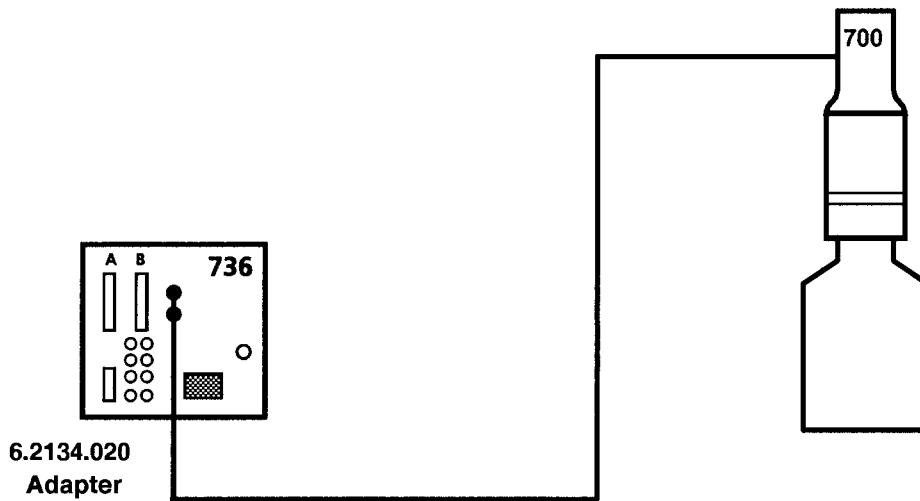


Fig. 5-2: Connection of the external buret

### 5.1.3 Connection of a printer

A variety of printers can be connected to the RS232 interface of the 736 GP Titrino. If you connect a printer other than one of those mentioned below, ensure that the Epson mode is emulated or that it uses the international character set following the IBM Standard Table 437 and IBM-compatible graphics control characters.



If a **balance** is connected at the same time as a printer, the 6.2125.030 Adapter must be used. The printer must be plugged into the "data out" receptacle of the adapter. It can be operated only with the simple hardware handshake (HWs) or without handshake.

The connection of a selection of printers is facilitated by the following Table:

| Printer type             | Cable      | Settings at GP Titrino                                                                              | Settings at printer                                                                                                                                                                                                         |
|--------------------------|------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Citizen IDP560 RS</b> | 6.2125.050 | baud rate: 9600<br>data bit: 7<br>stop bit: 1<br>parity: even<br>handshake: HWs<br>send to: Citizen | <b>DIP switches:</b><br>1 on<br>2 off }<br>3 off } 9600 baud<br>4 off }<br>5 on 7 bit<br>6 -<br>7 off } even<br>8 on } parity<br>Set printer to on-line with <sel >                                                         |
| <b>Seiko DPU-411</b>     | 6.2125.020 | baud rate: 9600<br>data bit: 7<br>stop bit: 1<br>parity: even<br>handshake: HWs<br>send to: Seiko   | <b>DIP switches:</b><br><b>DIP01</b><br>1 off serial<br>2 off no auto LF<br>3 on 40 characters<br>4 on character style<br>5 off zero represent.<br>6 off }<br>7 on } USA<br>8 on } -character set<br>Set printer to on-line |

The following printers can also be connected:

| Printer                                        | Cable      | Settings at 736 Titrino                                                            | Settings at printer  |
|------------------------------------------------|------------|------------------------------------------------------------------------------------|----------------------|
| Epson Printer with 6-pin circular connector 1) | 6.2125.040 | send to: Epson<br>data bit: 8<br>parity: none<br>handshake: HWs                    | 8 bit<br>no parity   |
| Epson Printer with #8148 interface             | 6.2125.050 | send to: Epson<br>data bit: 7<br>parity: even<br>handshake: HWs                    | 7 bit<br>even parity |
| Epson LX-300 <sup>1)</sup>                     | 6.2125.050 | send to: Epson<br>baud rate: 9600<br>data bit: 8<br>parity: none<br>handshake: HWs | see printer manual   |

| Printer                                            | Cable                                                | Settings at 736 Titrino                                                            | Dip switches at printer                                                                                                                                                                          |
|----------------------------------------------------|------------------------------------------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HP: Desk Jet with serial interface <sup>1)</sup>   | 6.2125.050                                           | send to: HP<br>baud rate: 9600<br>data bit: 8<br>parity: none<br>handshake: HWs    | A: <br>For A4 paper<br>B:  |
| HP: Desk Jet with parallel interface <sup>1)</sup> | 6.2125.020 + parallel-seriel converter<br>2.145.0300 | send to: Epson<br>baud rate: 9600<br>data bit: 8<br>parity: none<br>handshake: HWs | see printer manual                                                                                                                                                                               |

1): When connecting a balance at the same time, which only is capable to work with 7 bit, set "parity space" on the balance, while Printer and Titrino work on 8 bit, no parity.

### 5.1.4 Connection of a balance

The following balances can be connected to the RS232 output of the GP Titrino:

| Balance                                              | Cable                                                                                                                                                           |
|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sartorius MP-8, MC1                                  | 6.2125.070                                                                                                                                                      |
| Mettler AB, AG (LC-RS25)<br>AM, PM                   | Cable in scope of delivery of balance<br>From Mettler: ME 33995: Green lead to pin 2, brown to pin 3, white to pin 7, yellow to pin 20 of the 25-pin connector. |
| Interface 016:                                       | Cable in scope of delivery of interface 016:<br>Red lead to pin 3, white lead to pin 7 of the 25-pin connector                                                  |
| Interface 011 or 012:                                | 6.2125.020                                                                                                                                                      |
| Mettler AT                                           | From Mettler: ME 33995: Green lead to pin 2, brown to pin 3, white to pin 7, yellow to pin 20 of the 25-pin connector.                                          |
| AND Models ER-60, 120, 180, 182                      | 6.2125.020                                                                                                                                                      |
| Models FR-200, 300                                   | 6.2125.020                                                                                                                                                      |
| Models FX-200, 300, 320 with RS232 interface (OP-03) | 6.2125.020                                                                                                                                                      |
| Precisa Balances with RS232C interface               | 6.2125.080                                                                                                                                                      |

The balance type must be preselected at the GP Titrino with the <configuration> key. Balance and printer can be connected at the same time with the aid of the 6.2125.030 Adapter. The balance must then be plugged into the "data in" receptacle of the adapter.

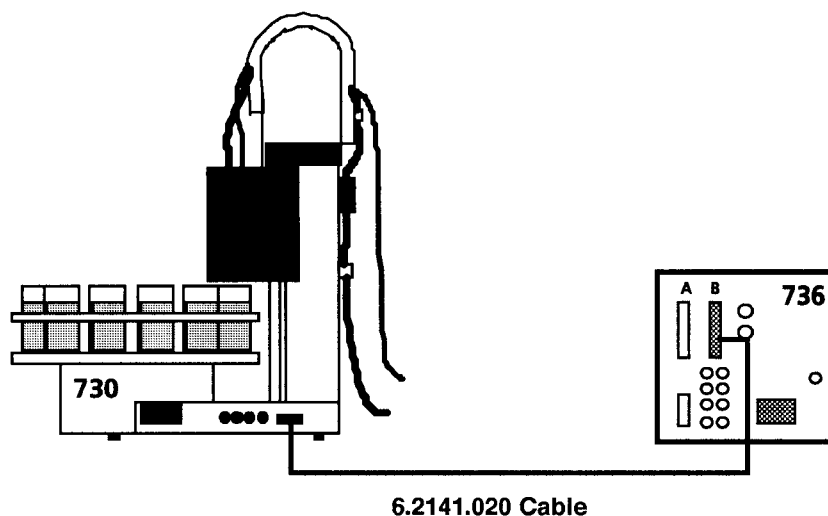
The weight is transferred as a number with up to 6 digits, sign and decimal point. Units and control characters sent by the balance are not transmitted. With the aid of a special input unit supplied by the balance manufacturer, in addition to the weight identifications and methods can be inputted from the balance. For this, the address of the identifications and method, resp. must be preselected on the input unit.

| Balance      | Method     | Id#1       | Id#2       | Id#3       |
|--------------|------------|------------|------------|------------|
| Sartorius    | METH or 27 | ID.1 or 26 | ID.2 or 24 | C-20 or 23 |
| Mettler (AT) | D (Mthd)   | C (ID#1)   | B (ID#2)   | A (c20)    |

## 5.1.5 Connection of a sample changer

The sample changer is connected as follows:

### 730 Sample Changer:



With 6.2141.030 cable (instead of 6.2141.020), two Titrimos can be connected to the 730 Sample Changer at the same time.

### 673/674 Sample Changer with 664 Control Unit:

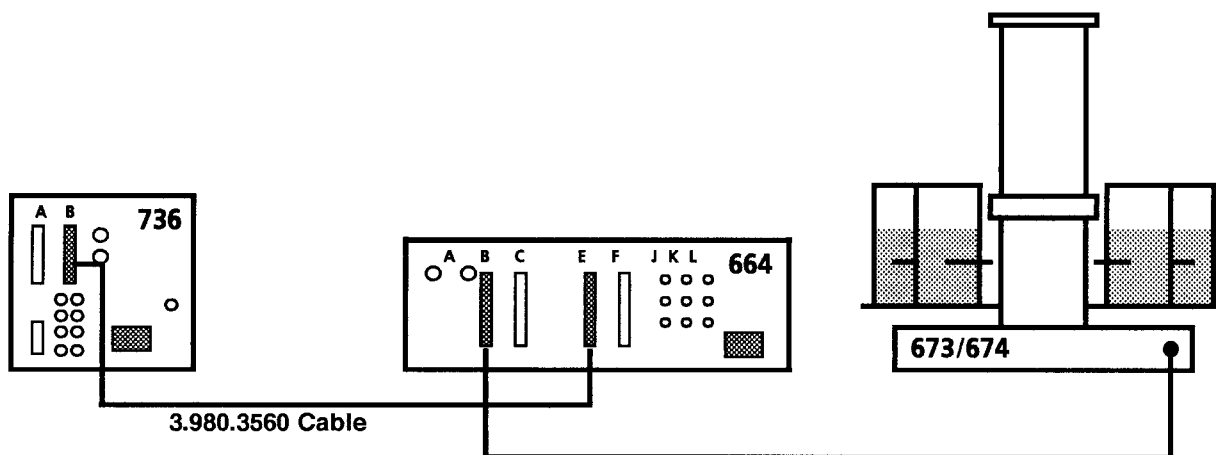


Fig. 5-3: Connection of a sample changer

- The "remote" socket allows not only connection of a sample changer but also additional control functions. Pin assignment of the "remote" socket and control possibilities, see page 161.
- If a calibration has to be performed with the sample changer, the calibration parameter "sample changer:" must be set to "ON".
- In connections with the sample changer, "auto start" should be set to "OFF" in the < configuration > key. The start command is given by the 730 Sample Changer or the 664 Control Unit.

## 5.1.6 Connection of a recorder

The recorder is connected to the analog output of the GP Titrimo:

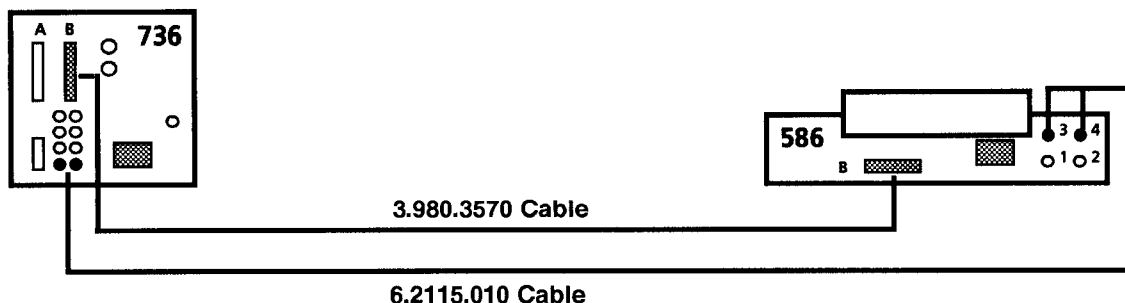


Fig. 5-4: Connection of a recorder

If the connection is set up with the 3.980.3570 cable, the chart feed axis of the recorder becomes the volume axis, i.e. the signal at the analog output is plotted against volume. The chart length per  $V_{\text{burette}}$  corresponds to the set chart speed on the recorder in mm. For 400 mm/min and 200 mm/min the maximum dosing rate  $v_{\text{max}}$  has to be reduced to  $\frac{1}{4} v_{\text{max}}$ , or  $\frac{1}{2} v_{\text{max}}$ , respectively.

If the connection is not set up with the 3.980.3570 cable, the chart feed axis of the recorder becomes the time axis and the signal at the analog output is plotted against time. For such curves, another laboratory recorder can be connected instead of the 586 Labograph.

The signal at the analog output can be preselected on the GP Titrimo (<configuration key>, "> peripheral units", "record:"). The following are available:

| Preselection at GP-Titrimo | Meaning              | Resolution, Signal at analog output                                                                                                                                                                        |
|----------------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| U                          | Voltage              | pH = 0.00: -700 mV<br>pH = 7.00: 0 mV<br>pH = 14.00: +700 mV<br>U = +1 mV: +1 mV<br>U = -1 mV: -1 mV<br>I = +1 uA: +10 mV<br>I = -1 uA: -10 mV<br>T = 0 °C: 0 mV<br>T = +1 °C: +10 mV<br>T = -1 °C: -10 mV |
| dU/dt                      | Measured value drift | 1 mV/min: 1 mV<br>1 °C/min: 1 mV<br>1 uA/min: 10 mV                                                                                                                                                        |
| V                          | Volume               | 1 Zylindervolumen: 2000 mV                                                                                                                                                                                 |
| dV/dt                      | Volume drift         | 100 µl/min: 1000 mV                                                                                                                                                                                        |
| U(rel)                     | Control deviation    | ΔpH = 1: 100 mV<br>ΔU = 1 mV: 1 mV<br>ΔI = 1 uA: 10 mV                                                                                                                                                     |
| T                          | Temperature          | ΔT ±1 °C: 10 mV<br>T = 0 °C: 0 mV                                                                                                                                                                          |

## 5.1.7 Connection of a computer

The computer is connected as follows:

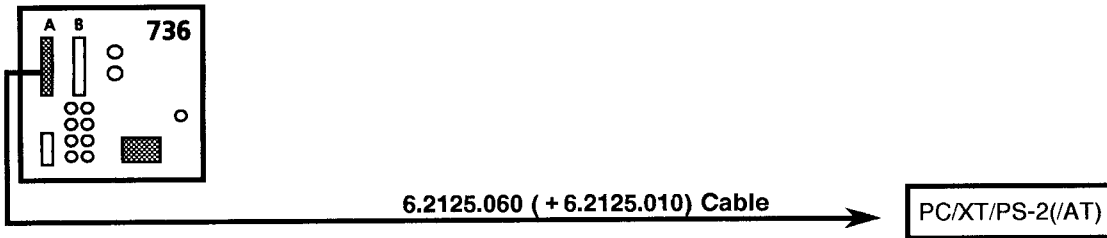


Fig. 5-5: Connection of a computer

For the connection of IBM® AT computers, the 6.2125.010 Adapter is also needed.

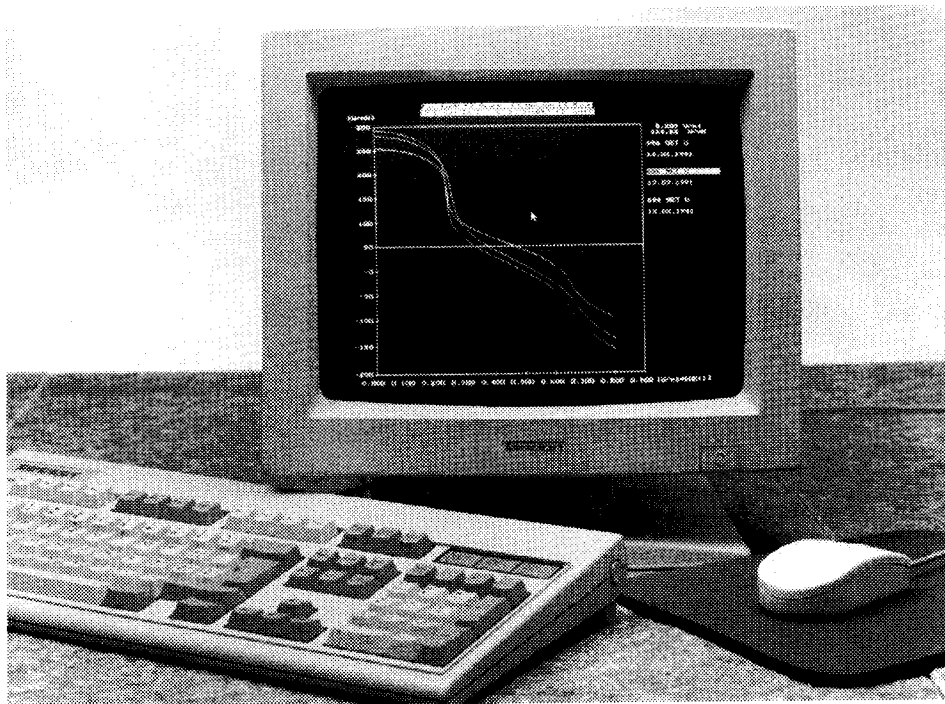
Preselections on Titrino:

RS232 settings: depend on the control program of the computer

Send to: IBM

Program package for the data transfer GP Titrino ↔ computer,  
3½" diskettes, in PASCAL and BASIC

6.6022.000



## 5.2 Installation of the titration vessel, connection of electrodes

### 5.2.1 Setting up the titration vessel

The titration vessel is set up as shown in Fig. 5-6. 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  $\text{CO}_2$  or  $\text{O}_2$  can disturb the titration.
- positioning the burette tip as centrally as possible, above the stirring bar.



Fig. 5-6: Setting up the titration vessel

## 5.2.2 Connection of the sensors

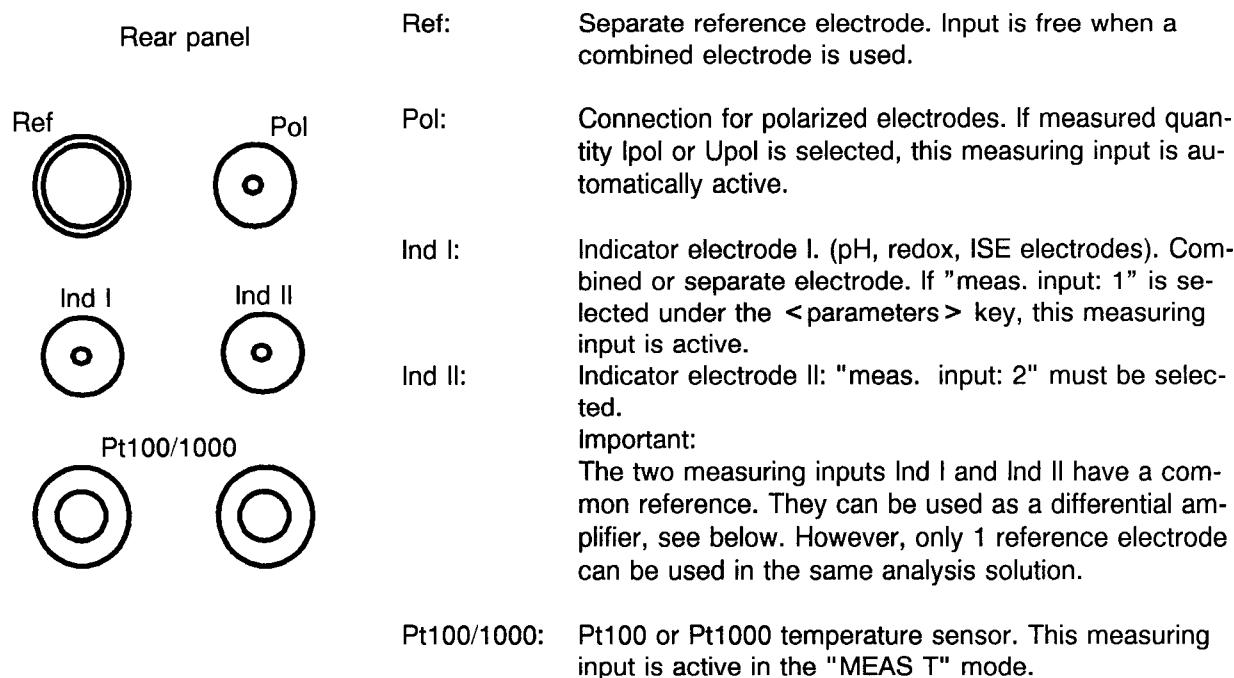


Fig. 5-7: Connection of electrodes

## Differential potentiometry

In potentiometric measurements in media of low conductivity, e.g. in organic solvents, high-impedance electrode assemblies such as pH electrodes record noise voltages which arise from stray electrostatic and electromagnetic fields. Particularly high field strengths occur through friction at insulators such as plastic floors, synthetic clothing, etc; conditions which can appear in every normal laboratory environment.

Problems of this type can be solved by measurement using a differential amplifier. Here, the indicator and reference electrode are each connected to a high-impedance measuring input. It is important to ensure that both electrodes have identical shielding and are thus symmetrical with regard to the recording of noise signals. An auxiliary electrode provides the electrical connection between the reference point of the amplifier circuit and the measurement solution.

Recommended electrodes:

| Measuring input | Manual determinations                                  | Determinations at sample changer                       |
|-----------------|--------------------------------------------------------|--------------------------------------------------------|
| Ind I           | 6.0133.100 pH glass electrode                          | 6.0130.100 pH glass electrode                          |
| Ind II          | 6.0729.100 double-shielded Ag/AgCl reference 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 burette tip with earthing may be used in some cases. Use burette tips without anti-diffusion valve!

## 5.3. Preparing the Exchange Unit

The Exchange Units are available in brown or clear glass with light protection. The models with light protection or in brown glass should be used for light-sensitive reagents (silver nitrate, Karl Fischer, etc.).

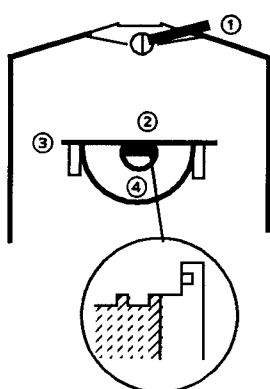
### Accuracy data:

| Burette volume<br>$V_{bur}$ (in ml) | Abs. error rel. to<br>nominal value<br>$\pm \Delta V$ (in ml) | Reproducibility error<br>Accuracy<br>$\pm \Delta V$ (in ml) | Resolution of the<br>display<br>$\Delta V$ (in ml) |
|-------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------|----------------------------------------------------|
| 1.000                               | 0.003                                                         | 0.001                                                       | 0.001                                              |
| 5.000                               | 0.015                                                         | 0.005                                                       | 0.001                                              |
| 10.000                              | 0.02                                                          | 0.005                                                       | 0.001                                              |
| 20.000                              | 0.03                                                          | 0.01                                                        | 0.002                                              |
| 50.000                              | 0.05                                                          | 0.04                                                        | 0.005                                              |

### Note:

In gravimetric checks of the dispensed volume, the air buoyancy (ca. 0.1%) must be taken into account in the weighing. Consideration should also be given to evaporation.

### 5.3.1 Setting up the 6.3011.XXX...6.3014.XXX Exchange Units



Before mounting the Exchange Unit, check that stopcock switch ① is on the right and coupling ② is parallel to ridge ③ and even with rings ④. The coupling can be adjusted with the 6.2739.010 key.

- Remove packing plate below the reagent bottle.
- Mount retaining clips for reagent bottle, see Fig. 6-1, page 204.

Fig. 5-8: Bottom of Exchange Unit

If you do not wish to use the reagent bottle supplied, convert your Exchange Unit as follows:

Snap in the reagent bottle retaining clips so that the reagent bottle sits snugly in the Exchange Unit. For different original reagent bottles, you need a special bottle siphon and possibly a threaded adapter. The following bottle siphons are available:

|                                                                                                                      |                         |
|----------------------------------------------------------------------------------------------------------------------|-------------------------|
| for bottles with GL45 thread, e.g. Riedel-de Haën (1 L), Baker<br>(bottle siphon included in the standard equipment) | 6.1602.100              |
| for bottles with S40 thread, e.g. Merck                                                                              | 6.1602.110              |
| for bottles with 32 mm thread, e.g. Fluka,<br>Riedel-de Haën (500 mL)                                                | 6.1602.100 + 6.1618.000 |
| for bottles with 28 mm thread, e.g. Fisher                                                                           | 6.1602.100 + 6.1618.010 |

- Screw the appropriate bottle siphon onto the reagent bottle.
- If necessary, replace the 6.1602.100 bottle siphon with the combination you need.

The holder on the right serves to hold the burette tip; in the holder on the left you can store, for instance the electrode associated with the reagent.

### 5.3.2 Assembly of the 6.3006.XXX/6.3007.XXX Exchange Units

See also Fig. 6-3, page 206.

- The instrument without Exchange Unit is set to zero.
- Mount Exchange Unit (without glass cylinder) from the front on the sliding plate and push right back.
- Allow piston spindle to run out by ca. 2 cm.
- Carefully grease PTFE piston (see section 5.3.5), assemble coupling and carefully slide glass cylinder over it from above ensuring exact axial alignment. (If the PTFE piston slips out of the coupling, the 6.1546.010 piston rod can be used to shift the piston in the glass cylinder.)
- Center cylinder in the slot of the exchange support.
- Clamp cylinder with 6.2035.00 flange and 6.1549.00 clamping ring moderately tightly. (For 50 mL units, use 6.1551.000 plastic flange.)
- Fit remaining components of Exchange Unit.
  - . Tubing connections:

Flat stopcock

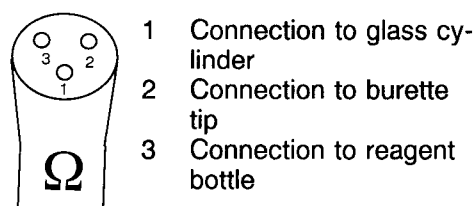


Fig. 5-9: Stopcock tubing connections

- . Tighten screw nipple by hand. Nipples should be tightened with the 6.2739.000 key only at inaccessible locations and not too tightly (tightening force ca. 100 p ≈ 1 N with 5 cm key). The tubing must not be pinched.
- Let piston move to zero position.

### 5.3.3 First-time filling

- Fill the reagent bottle with the titrant.
- Insert a cotton wool plug in the adsorption tube and add a suitable protective agent. Cover with another cotton wool plug and close with cover.
- Press <DOS> key until the piston is in the very top position.
- Press <STOP/FILL> .

Repeat filling process in both directions until the glass cylinder together with the connections up to the burette tip is filled. To allow air to escape better, hold burette tip up. Experience has shown that small air bubbles do not cause any disturbance as they remain connected to the wall even when the piston moves quickly.

### 5.3.4 Changing the Exchange Unit

When the Exchange Unit is mounted or removed, the burette must be in the zero position (filled + drive play taken up), otherwise the exchange support will be mechanically arrested by the piston spindle.

All Exchange Units are adjusted such that the spindle is even with the sliding plate when in the zero position thereby ensuring universal interchangeability.

If an Exchange Unit can not be mounted, the coupling of the PTFE piston must be adjusted with the aid of the 6.2739.010 Key in the case of the 6.3011.XXX...6.3014.XXX models or with the 6.1546.010 Piston Rod with the other models.

**Caution:** If no liquid is aspirated into the glass cylinder of the Exchange Unit upon filling – despite a filled reagent bottle and correct tubing connections – the cylinder can be under vacuum. In this case, it may be dangerous to remove the Exchange Unit (the cylinder may break). Aerate the cylinder by opening the tubing connection at the head of the cylinder.

### 5.3.5 Maintenance

It is best to store the burette tip in the same solvent as the reagent to prevent crystallisation of reagent: Fill glass holder with solvent, pass burette tip through the bulb stopper and place in the glass holder. In the case of KF reagent, use methanol as storage solution. Warning: Before dispensing check that the burette tip is not blocked!

Emptying and cleaning:

- Discharge as much titrant as possible.
- Burette in the zero position, disconnect connections to bottle and burette tip.
- Remove light protection, ev.
- With 6.3011.XXX and 6.3012.XXX Exchange Units, remove light protection.
- Undo attachment of the glass cylinder and let spindle run out until the piston can be disengaged.
- Completely empty cylinder with the aid of the 6.2739.010 Key or 6.1546.010 piston rod and carefully pull out piston.
- Rinse and clean individual parts properly. (Especially ensure that no reagent remains in the threaded hole of the PTFE tubing connections.)

#### PTFE piston

The PTFE piston must be handled with care to avoid damaging the lip seals. Residual grease should be wiped off with a soft, lint-free cloth. Carefully apply fresh grease with your finger to the lip seals and in the spaces. Wipe off leading edge to ensure that the reagent does not come into contact with the grease. When inserting the piston in the glass cylinder, ensure that it is introduced straight and not at an angle.

SISCO 3000 (Swedish Iron & Steel Corp.) grease - this is not silicon grease (!), the name refers to the manufacturer - has well proved its worth since our tests have shown that it is not only inert to all titrants in normal use, but also has a favourable viscosity.

A worn piston must be replaced immediately to prevent titrant leaking out and corroding the drive spindle.

#### Stopcock

The stopcock needs no maintenance. If a defect is suspected, it is best to return it to the manufacturer for checking unopened (improper handling can render the stopcock completely useless). It is thus advisable to keep a 6.1542.0X0 stopcock as a spare at all times.

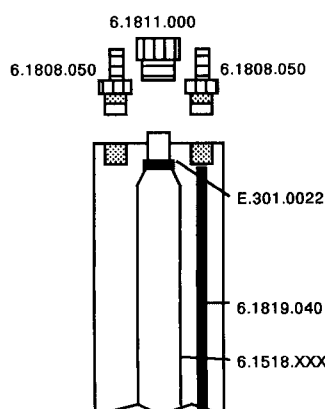
Removing the stopcock:

- . Switch lever to "↑" ≙ dispensing.
- . Unscrew nipples of the tubing connections.
- . Pull out 6.1542.0X0 stopcock upwards (pull hard!).

Refitting:

- . Switch lever to "↑" ≙ dispensing.
- . For PTFE stopcock: Align marking on shaft and housing of stopcock.
- . Insert stopcock from above in the holder and press down until the quick-release coupling engages.
- . Screw in screw nipples.

### 5.3.6 Mounting the thermostat jacket of the 6.3011.XXX...6.3014.XXX Exchange Units



1. Undo tubing connection of 6.1518.XXX glass cylinder.
2. Remove light protection.
3. Unscrew 6.1811.000 screw fitting at glass fitting.
4. Roll O-ring upwards out of groove on glass fitting. Do not use any hard objects to remove the O-ring, otherwise the edge of the glass fitting can splinter! If all else fails, cut O-ring. Ordering number for new O-ring: E.301.0022.
5. Lightly grease inside of 6.1536.010 thermostat jacket at the bottom and mount.
6. Lightly grease O-ring and attach to glass fitting.
7. Attach upper part of 6.1811.000 screw fitting to glass fitting.
8. Make connection to stopcock.
9. Insert 6.1819.040 PTFE tubing in thermostat jacket and attach thermostat tubing using 6.1808.050 coupling.

Fig 5-10: Thermostat jacket

### 5.3.7 6.3006.113 Micromodel - 1 mL

#### Assembly:

See also Fig. 6-4, page 207.

- Dosimat without Exchange Unit is in the zero position.
- Mount Exchange Unit (without glass cylinder) from the front on the sliding plate and push right back.
- Allow piston spindle of Dosimat to run out by ca. 2 cm
- Mount 6.3022.113 Exchange Set and screw tightly.
- Join coupling of the piston spindle to that of the exchange set and move piston spindle of the Dosimat into the zero position.
- Fasten fitting with 6.2035.000 metal flange and V.911.0040 knurled nuts using 6.2035.000 metal flange.
- Turn glass piston until curve is aligned towards the handle.
- Attach remaining components of the Exchange Unit.

. Tubing connections:

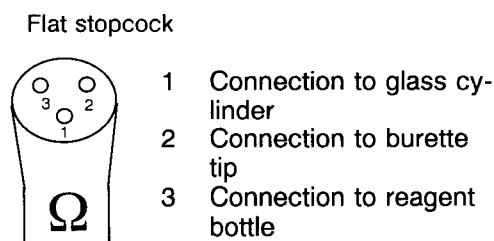


Fig. 5-11: Stopcock tubing connections

- . Tighten tubing connections firmly by hand. Use 6.2739.000 key at all inaccessible positions and tighten using a moderate amount of force (tubing must not be pinched).

**Warning:** Solids block the capillary tubing! Never pull on the tubing!

- Move piston to zero position.

#### Filling:

- Fill the reagent bottle with titrant.
- Insert a cotton wool plug in the adsorption tube and add a suitable protective agent. Cover with cotton wool and close with cover.
- Press <DOS> key until the piston is in the very top position.
- Press <STOP/FILL> .

Repeat filling process in both directions until the glass cylinder together with the connections up to the burette tip is filled. Drive any air bubbles to the top by lightly tapping the glass cylinder. If the air bubbles do not move, the Exchange Unit must be disassembled and the glass piston carefully degreased and dried.

#### Cleaning:

- Undo tubing connection to reagent bottle, repeat "dispensing" and "filling" until the piston is as empty as possible.
- Undo tubing connection to glass piston.
- Remove Exchange Unit from Dosimat.
- Unscrew knurled nuts and remove piston and fitting.
- Unscrew exchange set from fitting and disassemble Exchange Unit into its parts.
- Clean all parts thoroughly and dry (ensure that no reagent remains in the threaded holes of the tubing connections).
- If need be, replace 6.2712.000 Seal (round part pointing upwards).

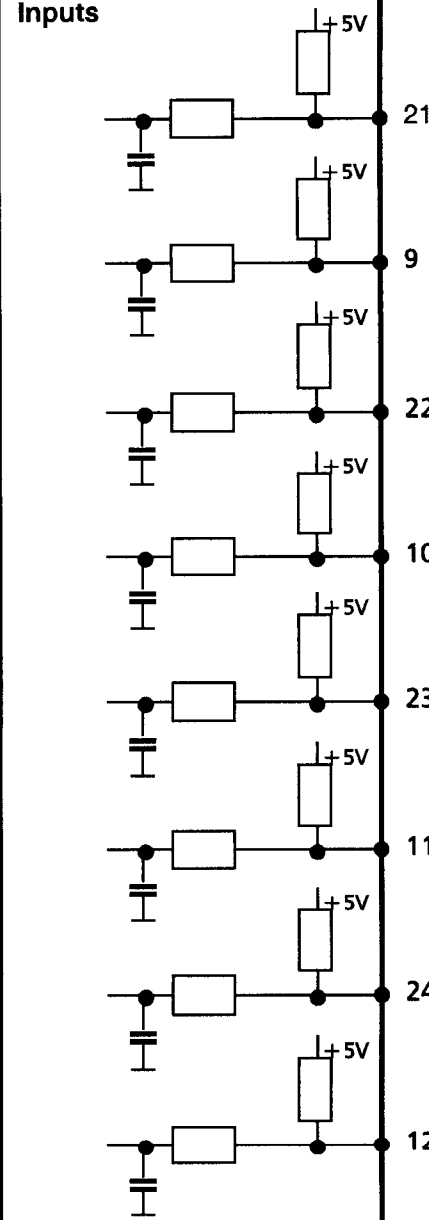
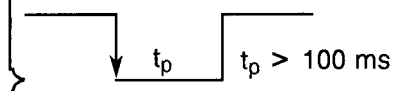
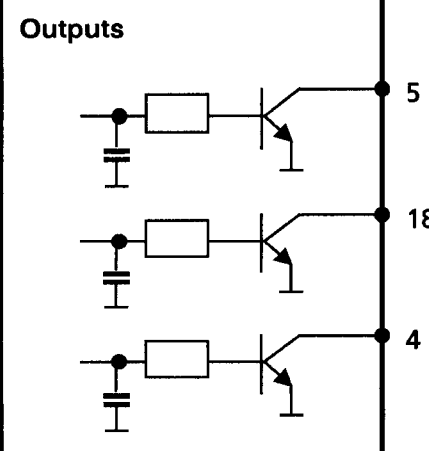
## 6. Appendix

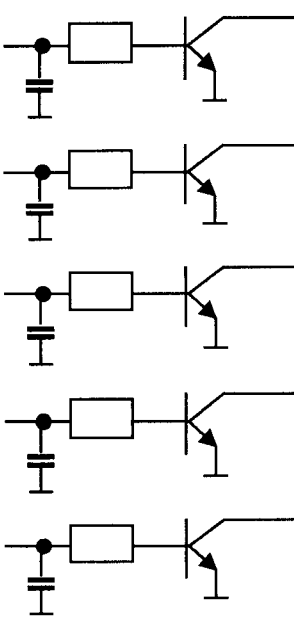
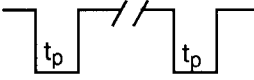
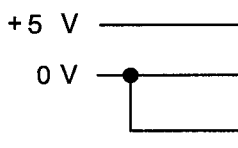
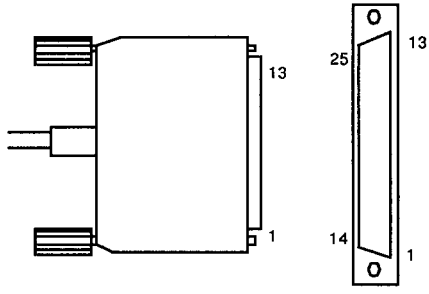
### 6.1 Technical specifications

|                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Modi                                                                                     | <p>DET: <b>D</b>yamic <b>E</b>quivalence Point Titration<br/> MET: <b>M</b>onotonic <b>E</b>quivalence Point Titration<br/> SET: <b>S</b>et <b>E</b>nd point Titration<br/> KFT: <b>K</b>arl Fisher Titration<br/> STAT: Keeping a measured value constant<br/> DOS: <b>D</b>osing<br/> DOC: Controlled dosing with measured value gradient<br/> MEAS: <b>M</b>EASurement<br/> CAL: pH calibration<br/> TIP: Links commands to titration procedure</p> |
| Measuring input                                                                          | <p>2 high-impedance measuring inputs for pH, redox and ISE electrodes<br/> 1 reference input for a separate reference electrode<br/> May also be used as a differential amplifier.<br/> 1 measuring input for polarized electrodes<br/> 1 measuring input for temperature sensor Pt100 or Pt1000</p>                                                                                                                                                   |
| Measuring range                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| pH value (pX)                                                                            | 0... ± 20.00                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Voltage                                                                                  | 0... ± 2000 mV                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Current                                                                                  | 0... ± 200.0 µA                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Temperature                                                                              | -150.0... + 450.0 °C                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Error of measurement of instrument (without sensors)<br>at 25 °C and a warmed-up Titrino |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| pH value                                                                                 | ± 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Voltage                                                                                  | ± 2 mV                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Temperature                                                                              | ≤ 0.2 °C in the range of 0... + 100 °C                                                                                                                                                                                                                                                                                                                                                                                                                 |
| as a function of the ambient<br>temperature                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| pH value, voltage                                                                        | typical 40 µV/K                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Temperature                                                                              | 0.04 °C/K                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Measuring amplifier                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Input resistance                                                                         | > 10 <sup>13</sup> Ω                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Offset current                                                                           | < 3 · 10 <sup>-13</sup> A                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Deviation of offset voltage as a<br>function of the ambient temperature                  | 15 µV/K                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Polarizer                                                                                | <p>I<sub>pol</sub>: 0... ± 127 µA<br/> U<sub>pol</sub>: 0... ± 1270 mV, in 10 mV steps</p>                                                                                                                                                                                                                                                                                                                                                             |
| Dosification                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Volume of a buret cylinder                                                               | 1, (2), 5, 10, 20 or 50 ml                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Resolution                                                                               | 10 000 steps per buret cylinder                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Buret connections                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Titrating burets                                                                         | 2 external and 1 internal buret<br>external: 685 Dosimat or 700 Dosino                                                                                                                                                                                                                                                                                                                                                                                 |
| Auxiliary burets                                                                         | 2 additional burets: 725 or 665 Dosimats                                                                                                                                                                                                                                                                                                                                                                                                               |
| Materials                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Housing                                                                                  | polybutyleneterephthalate (PBTP)                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Keypad covers                                                                            | polycarbonate (PC)                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Display                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Height of characters                                                                     | LCD, 2 lines of 24 characters each<br>5 mm                                                                                                                                                                                                                                                                                                                                                                                                             |

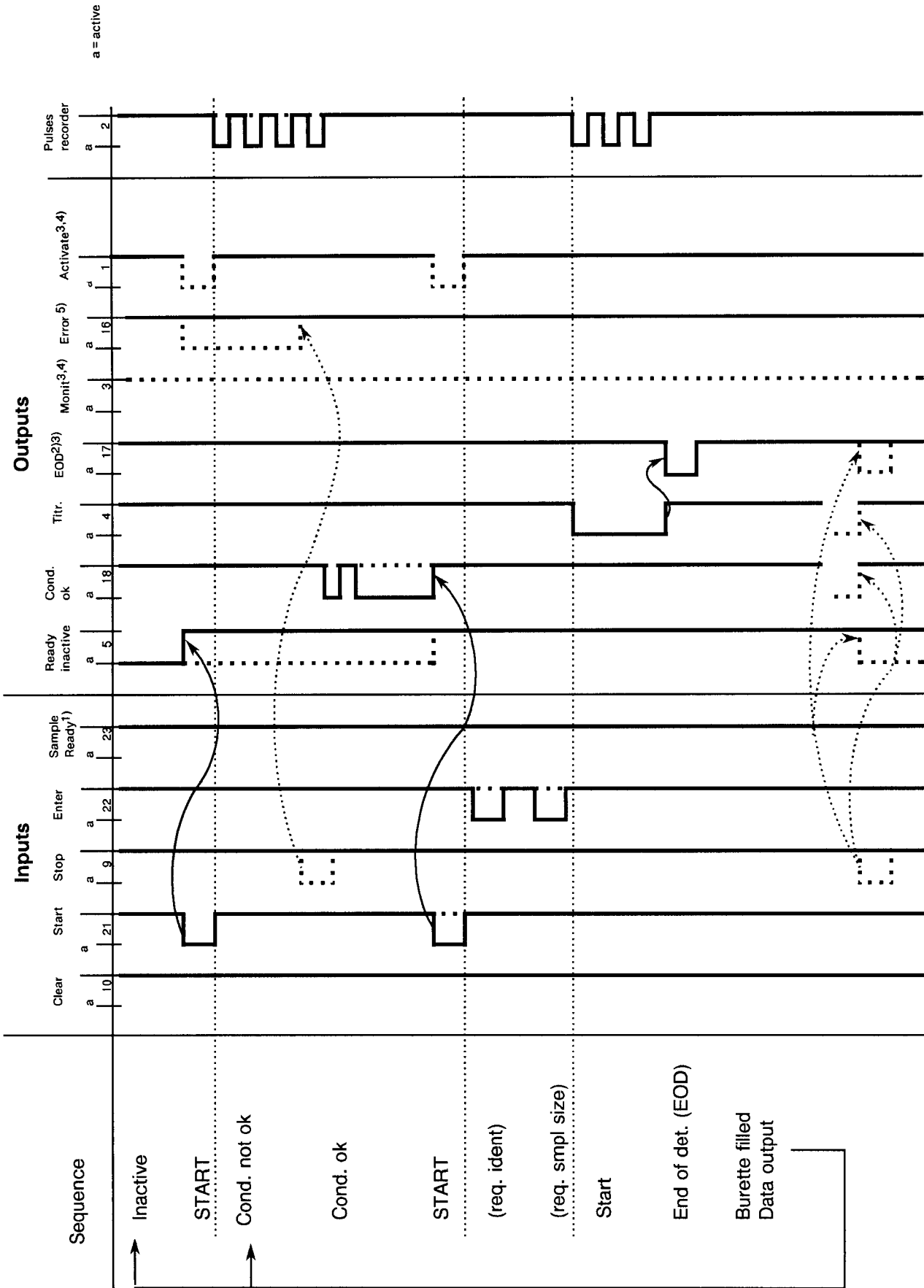
|                                 |                                                                                                                                                                                                                                             |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 supply                                                                                                                                                                                                              |
| Flash                           | Read only                                                                                                                                                                                                                                   |
| RS232 interface                 | for printer and balance connection<br>or<br>computer connection: completely remote controllable from external                                                                                                                               |
| Conventional input/output lines | for connection of sample changer or robot                                                                                                                                                                                                   |
| Input lines                     | Start, Stop, Enter, Clear, Sample Ready                                                                                                                                                                                                     |
| Output lines                    | Ready, Conditioning ok, Titration, EOD (end of determination), Error, Activate, Monitoring                                                                                                                                                  |
| Analog output                   |                                                                                                                                                                                                                                             |
| Output signal                   | -2000 ... 2000 mV                                                                                                                                                                                                                           |
| Signal at analog output         | depending on preselection:<br>U (measuring value)<br>dU/dt (measured value drift)<br>V (volume)<br>dV/dt (volume drift)<br>U(rel) (control deviation)<br>T (Temperature)                                                                    |
| Resolution                      | 1 mV (12 bit), see also page 149                                                                                                                                                                                                            |
| Ambient temperature             |                                                                                                                                                                                                                                             |
| Nominal operational range       | 5 ... 40 °C                                                                                                                                                                                                                                 |
| Storage, transport              | - 20 ... 60 °C                                                                                                                                                                                                                              |
| Safety specifications           | Designed and tested in accordance to IEC publication 1010, safety class I. This manual contains some information and warnings which have to be followed by the user to ensure safe operation and to retain the apparatus in safe condition. |
| Mains connection                |                                                                                                                                                                                                                                             |
| Voltage                         | 100, 117, 220, 240 V ± 10% (switchable)                                                                                                                                                                                                     |
| Frequency                       | 50 ... 60 Hz                                                                                                                                                                                                                                |
| Power consumption               | 15 VA                                                                                                                                                                                                                                       |
| Fuse                            | Thermal fuse                                                                                                                                                                                                                                |
| Dimensions with Exchange Unit   |                                                                                                                                                                                                                                             |
| Width                           | 150 mm                                                                                                                                                                                                                                      |
| Height                          | 450 mm                                                                                                                                                                                                                                      |
| Depth                           | 275 mm                                                                                                                                                                                                                                      |
| Weight, incl. keypad            | app. 3.4 kg                                                                                                                                                                                                                                 |

## 6.2 Pin assignment of the "Remote" socket

|                                                                                                     | external                                                                                              | Function                                                                                                                            |
|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| <b>Inputs</b><br> | 21                                                                                                    | Start<br>Stop<br>Enter <br>Functions see page 196 |
|                                                                                                     | 9                                                                                                     |                                                                                                                                     |
|                                                                                                     | 22                                                                                                    |                                                                                                                                     |
|                                                                                                     | 10                                                                                                    |                                                                                                                                     |
|                                                                                                     | 23                                                                                                    | Clear<br>Sample Ready<br>Are not used in titration sequences                                                                        |
|                                                                                                     | 11                                                                                                    |                                                                                                                                     |
|                                                                                                     | 24                                                                                                    | not used                                                                                                                            |
|                                                                                                     | 12                                                                                                    |                                                                                                                                     |
|                                                                                                     | <b>Outputs</b><br> | 5                                                                                                                                   |
| 18                                                                                                  |                                                                                                       |                                                                                                                                     |
| 4                                                                                                   |                                                                                                       |                                                                                                                                     |

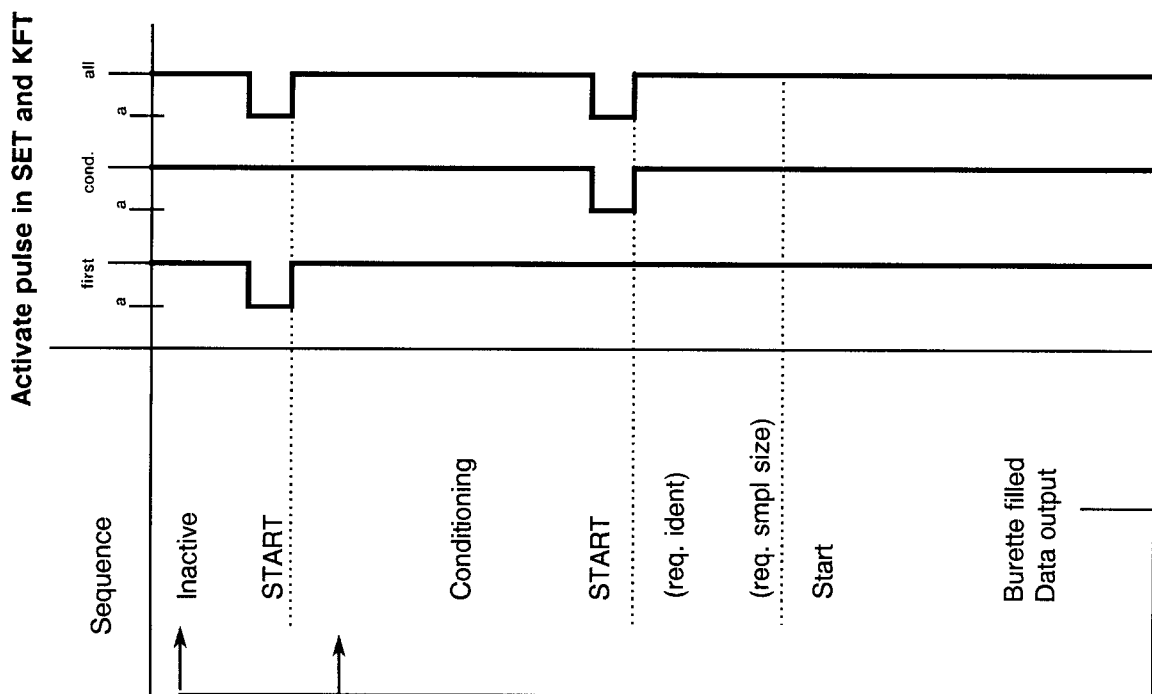
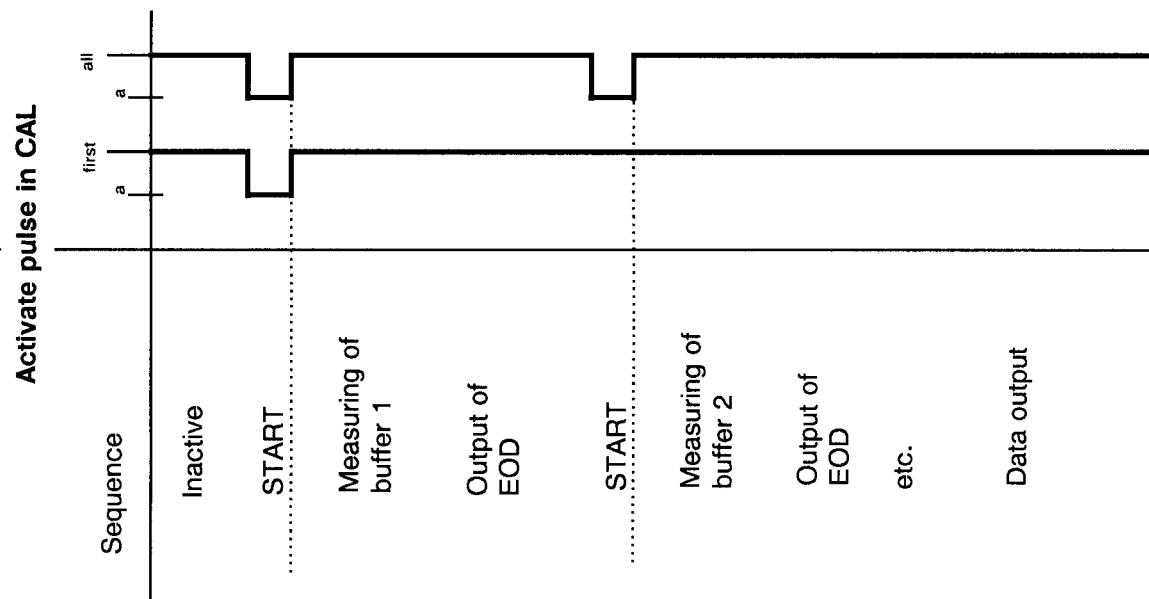
|                                                                                                               |                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Outputs</b></p>        | <p>17</p> <p>3</p> <p>16</p> <p>1</p> <p>2</p>           | <p>End of determination<br/>EOD</p> <p>Monitoring, L4 in TIP</p> <p>Error: active with errors</p> <p>Activate, as set in method<br/>(see also page 196). L6 in<br/>TIP</p> <p>Pulses for recorder</p>  <p><math>t_p = 150 \mu s</math></p> <p><math>V_{CE0} = 40 V</math><br/><math>I_C = 20 mA</math><br/><math>t_{Pulse} &gt; 100 ms</math></p> <p>Functions see<br/>page 196</p> |
| <p><b>Voltage</b></p>      | <p>+5 V ——— 15</p> <p>0 V ——— 14</p> <p>          25</p> | <p><math>I \leq 75 mA</math></p> <p>0 V: active<br/>5 V: inactive</p>                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                               |                                                          | <p>Contact arrangement at socket (male) for<br/>connector "Remote" (female)</p>  <p>View from solder side of connector</p> <p>Ordering numbers:<br/>K.210.9004 (shell) and K.210.0002</p>                                                                                                                                                                                          |
| <p>No liability whatsoever will be accepted for damage caused by improper interconnection of instruments.</p> |                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

### 6.2.1 Lines of the "Remote" socket during the titration



- 1) Beaker detector of Sample Changer.
- 2) In CAL, EOD is sent after every buffer. Automatic output of EOD can be switched off via RS232, see page 150.
- 3) Line can be set via RS232, see page 150.
- 4) Line can be set in TIP.
- 5) The error line is reset when the error is rectified.

Possible configurations of the activate pulse in SET, KFT and CAL



## 6.3 Warranty and certificates

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 embedding in wood shavings or similar material, the parts must be packed in a dustproof package (for instruments, use of a plastic bag is imperative). If open assemblies are enclosed in the scope of delivery that are sensitive to electromagnetic voltages (e.g. data interfaces etc.) these must be returned in the associated original protective packaging (e.g. conductive protective bag). (Exception: assemblies with built-in voltage source belong in a non-conductive protective packaging). For damage which arises as a result of non-compliance with these instructions, no warranty responsibility whatsoever will be accepted by METROHM.

Ionenanalytik • Analyse des ions • Ion analysis • Análisis iónico  
**736 GP Titrino**



Metrohm Ltd.  
CH-9101 Herisau  
Switzerland  
Phone + 41 71 353 85 85  
Fax + 41 71 353 89 01  
CompuServe 100031,3703

## 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:    | 736 GP 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:

|                                                    |                                            |
|----------------------------------------------------|--------------------------------------------|
| <i>Electromagnetic compatibility: Emission</i>     |                                            |
| EN50081-1/92, EN55022 / class B, EN55011 / class B | Generic emission                           |
| <i>Electromagnetic compatibility: Immunity</i>     |                                            |
| EN50082-2/94, EN50082-1/92                         | Immunity                                   |
| IEC801-2/91 level 4, EN50082-2, NAMUR/93           | Static discharge                           |
| IEC801-3, ENV50140/93 level 3                      | Radiated rf electromagnetic field immunity |
| IEC801-4, IEC1000-4-4/95 level 4                   | El. fast transient requirements            |
| IEC801-5, IEC1000-4-5/95 level 2/3                 | "Surges" immunity                          |
| IEC801-6, ENV50141/93 level 3                      | Immunity to conducted disturbances         |
| NAMUR/93 Paragr. 3.2.2.                            | Voltage dips, short interruptions          |
| <i>Security specifications</i>                     |                                            |
| IEC1010 class 1, EN61010 class 1, UL3101-1         |                                            |

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, analytical performance, and accuracy of results.

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, Nov. 14. 1995

Dr. J. Frank  
Development Manager

Ch. Buchmann  
Production and  
Quality Assurance Manager

Ionenanalytik • Analyse des ions • Ion analysis • Análisis iónico

**736 GP Titrino**



Metrohm Ltd.  
CH-9101 Herisau  
Switzerland  
Phone + 41 71 353 8585  
Fax + 41 71 353 89 01  
CompuServe 100031,3703

## EU Declaration of Conformity

The company Metrohm AG, Herisau, Switzerland, certifies herewith, that the following instrument:

### **736 GP Titrino**

meets the CE mark requirements of EU Directives 89/336/EWG and 72/23/EWG.

---

### Source of specifications:

|            |                                                                                 |
|------------|---------------------------------------------------------------------------------|
| EN 50081-1 | Electromagnetic compatibility, basic specification Emitted Interference         |
| EN 50082-2 | Electromagnetic compatibility, basic specification Interference Immunity        |
| EN 61010   | Safety requirements for electrical laboratory measurement and control equipment |

### Description of the apparatus:

All-purpose titrator with up to 3 titrating burets, programmable titration sequences and memory card for method storage.

---

Herisau, December 5, 1995

Dr. J. Frank  
Development Manager

Ch. Buchmann  
Production and  
Quality Assurance Manager

## 6.4 Scope of delivery and ordering designations

### 6.4.1 736 GP Titrino

**736 GP Titrino** ..... 2.736.0010  
including the following accessories:

|                                                                                             |            |
|---------------------------------------------------------------------------------------------|------------|
| 1 Keypad to 736 GP Titrino                                                                  | 6.2132.050 |
| 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<br>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 Application card with application methods                                                 | 6.6023.000 |
| 1 Instructions for Use for 736 GP Titrino                                                   | 8.736.1003 |
| 1 Quick References                                                                          | 8.736.1013 |
| 1 Short Operating Guide                                                                     | 8.736.1023 |

### Options

Accessories to separate order and on payment of extra charge:

#### Burets

##### *Titrating burets*

|                                       |            |
|---------------------------------------|------------|
| Dosimat 685                           | 2.685.0010 |
| Cable 736 GP Titrino – 685 Dosimat    | 6.2134.030 |
| 700 Dosino                            | 2.700.0010 |
| Adapter Dosino cable – 736 GP Titrino | 6.2134.020 |

##### *Auxiliaries*

|                                                                     |            |
|---------------------------------------------------------------------|------------|
| 665 Dosimat                                                         | 2.665.0010 |
| 725 Dosimat                                                         | 2.725.0010 |
| Cable 736 GP Titrino (activate pulse, line L6) – 665 or 725 Dosimat | 6.2139.000 |

### 728 Magnetic Stirrer

|                      |            |
|----------------------|------------|
| 728 Magnetic Stirrer | 2.728.0040 |
|----------------------|------------|

### 727 Ti Stand

|                                           |            |
|-------------------------------------------|------------|
| For rinsing and addition of fresh solvent | 2.727.0010 |
|-------------------------------------------|------------|

|             |            |
|-------------|------------|
| Rod stirrer | 2.722.0010 |
|-------------|------------|

or

|                                                                                          |            |
|------------------------------------------------------------------------------------------|------------|
| 727 Ti Stand with built-in magnetic stirrer and rinsing and addition<br>of fresh solvent | 2.727.0100 |
|------------------------------------------------------------------------------------------|------------|

|                     |            |
|---------------------|------------|
| <b>703 Ti Stand</b> | 2.703.0010 |
|---------------------|------------|

Magnetic stirrer, stand, siphoning device for  
waste solvent, addition of fresh solvent.

### Titration equipment

|                                                                        |       |            |
|------------------------------------------------------------------------|-------|------------|
| Titration vessel, volumes                                              |       |            |
| 1... 50 mL                                                             | ..... | 6.1415.110 |
| 5... 70 mL                                                             | ..... | 6.1415.150 |
| 10... 90 mL                                                            | ..... | 6.1415.210 |
| 20... 90 mL                                                            | ..... | 6.1415.220 |
| 50... 150 mL                                                           | ..... | 6.1415.250 |
| 70... 200 mL                                                           | ..... | 6.1415.310 |
| Thermostatable titration vessel, volumes                               |       |            |
| 1... 50 mL                                                             | ..... | 6.1418.110 |
| 5... 70 mL                                                             | ..... | 6.1418.150 |
| 10... 90 ml, order 6.2036.000 holding ring separately                  | ..... | 6.9914.023 |
| 20... 90 mL                                                            | ..... | 6.1418.220 |
| 50... 150 mL                                                           | ..... | 6.1418.250 |
| Titration vessel upper half for electrodes and buret tips (5 openings) | ..... | 6.1414.010 |
| Magnetic stirring bars, length                                         |       |            |
| 12 mm                                                                  | ..... | 6.1903.010 |
| 16 mm                                                                  | ..... | 6.1903.020 |
| 25 mm                                                                  | ..... | 6.1903.030 |
| Electrode holder                                                       | ..... | 6.2021.020 |
| Equipment for KF titrations                                            | ..... | 6.5609.000 |

### Electrodes

|                                                                    |       |            |
|--------------------------------------------------------------------|-------|------------|
| comb. pH glass electrode with SGJ, without cable                   | ..... | 6.0233.100 |
| comb. pH glass electrode, without cable                            | ..... | 6.0232.100 |
| comb. pH micro glass electrode, without cable                      | ..... | 6.0234.100 |
| comb. pH glass electrode with built-in T sensor, with SGJ          | ..... | 6.0238.000 |
| T adaptor for the connection of <u>one</u> electrode to 2 Titrimos | ..... | 6.2103.100 |
| T sensor (Pt1000) with SGJ, without cable                          | ..... | 6.1110.100 |
| Electrode cable, 1m                                                | ..... | 6.2104.020 |
| Cable for T sensor                                                 | ..... | 6.2104.080 |
| SGJ sleeve for electrodes without SGJ                              | ..... | 6.1236.040 |

### Printers

|                                                                    |              |            |
|--------------------------------------------------------------------|--------------|------------|
| Citizen printer iDP560 RS                                          | .....        | 2.140.0014 |
| Cable 736 GP Titrino – Citizen printer iDP560 RS                   | .....        | 6.2125.050 |
| Seiko printer DPU-411, 220 V                                       | .....        | 2.141.0014 |
| Seiko printer DPU-411, 120 V                                       | .....        | 2.141.0015 |
| Cable 736 GP Titrino – Seiko Printer DPU 411                       | .....        | 6.2125.020 |
| Cable 736 GP Titrino – EPSON printer with 6 pin plug               | .....        | 6.2125.040 |
| Cable 736 GP Titrino – EPSON printer with RS interface #8148       | .....        | 6.2125.050 |
| Cable 736 GP Titrino – EPSON printer LX300                         | .....        | 6.2125.050 |
| Cable 736 GP Titrino – HP Desk Jet (with serial interface)         | .....        | 6.2125.050 |
| Cable 736 GP Titrino – HP Desk/Laser Jet (with parallel interface) | 6.2125.020 + | 2.145.0300 |
| Adapter for simultaneous connection of printer and balance         | .....        | 6.2125.030 |

### Balance connection

|                                                             |       |                    |
|-------------------------------------------------------------|-------|--------------------|
| Sartorius balance MP8, MC1, connecting cable                | ..... | 6.2125.070         |
| Mettler AB, AG balances (Mettler interface LC-RS25)         | ..... | Cable with balance |
| Mettler AT, AM, PM balances and balances with interface 016 | ..... | Cable from Mettler |
| Mettler balances with interface 011 or 012                  | ..... | 6.2125.020         |
| AND balances (with RS232 interface OP-03), connecting cable | ..... | 6.2125.020         |
| Precisa balances, connecting cable                          | ..... | 6.2125.080         |
| Adapter for simultaneous connection of printer              | ..... | 6.2125.030         |

**PC connection, control via RS232 C interface**

|                                                                                                               |                         |
|---------------------------------------------------------------------------------------------------------------|-------------------------|
| Cable 736 GP Titrino – IBM® PC/XT/PS-2 or compatible                                                          | 6.2125.060              |
| Cable 736 GP Titrino – IBM® AT                                                                                | 6.2125.060 + 6.2125.010 |
| RS232 C extension cable                                                                                       | 6.2125.020              |
| Program package for the data transfer 736 GP Titrino – IBM® PC or compatible, 3½" diskettes, PASCAL and BASIC | 6.6022.000              |

**Analog recorder**

|                                      |                         |
|--------------------------------------|-------------------------|
| Labograph 586, 50 Hz                 | 2.586.0012              |
| Labograph 586, 60 Hz                 | 2.586.0013              |
| Cable 736 GP Titrino – Labograph 586 | 3.980.3570 + 6.2115.010 |

**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 |
| Cable 736 GP Titrino – 730 Sample Changer                          | 6.2141.020 |
| Cable 2x 736 GP Titrino – 730 Sample Changer                       | 6.2141.030 |
| Cable 736 GP Titrino – Control Unit 664 for Sample Changer 673/674 | 3.980.3560 |

## 6.4.2 Exchange Units

|                                                       |            |
|-------------------------------------------------------|------------|
| Buret cylinder volume 5 mL                            |            |
| Light protection, with ceramic flat stopcock .....    | 6.3013.153 |
| Light protection, with PCTFE/PTFE flat stopcock ..... | 6.3014.153 |
| Buret cylinder volume 10 mL                           |            |
| Light protection, with ceramic flat stopcock .....    | 6.3013.213 |
| Light protection, with PCTFE/PTFE flat stopcock ..... | 6.3014.213 |
| Buret cylinder volume 20 mL                           |            |
| Light protection, with ceramic flat stopcock .....    | 6.3013.223 |
| Light protection, with PCTFE/PTFE flat stopcock ..... | 6.3014.223 |
| Buret cylinder volume 50 mL                           |            |
| Light protection, with ceramic flat stopcock .....    | 6.3013.253 |
| Light protection, with PCTFE/PTFE flat stopcock ..... | 6.3014.253 |

Accessories, see Fig. 6-1...6-3.

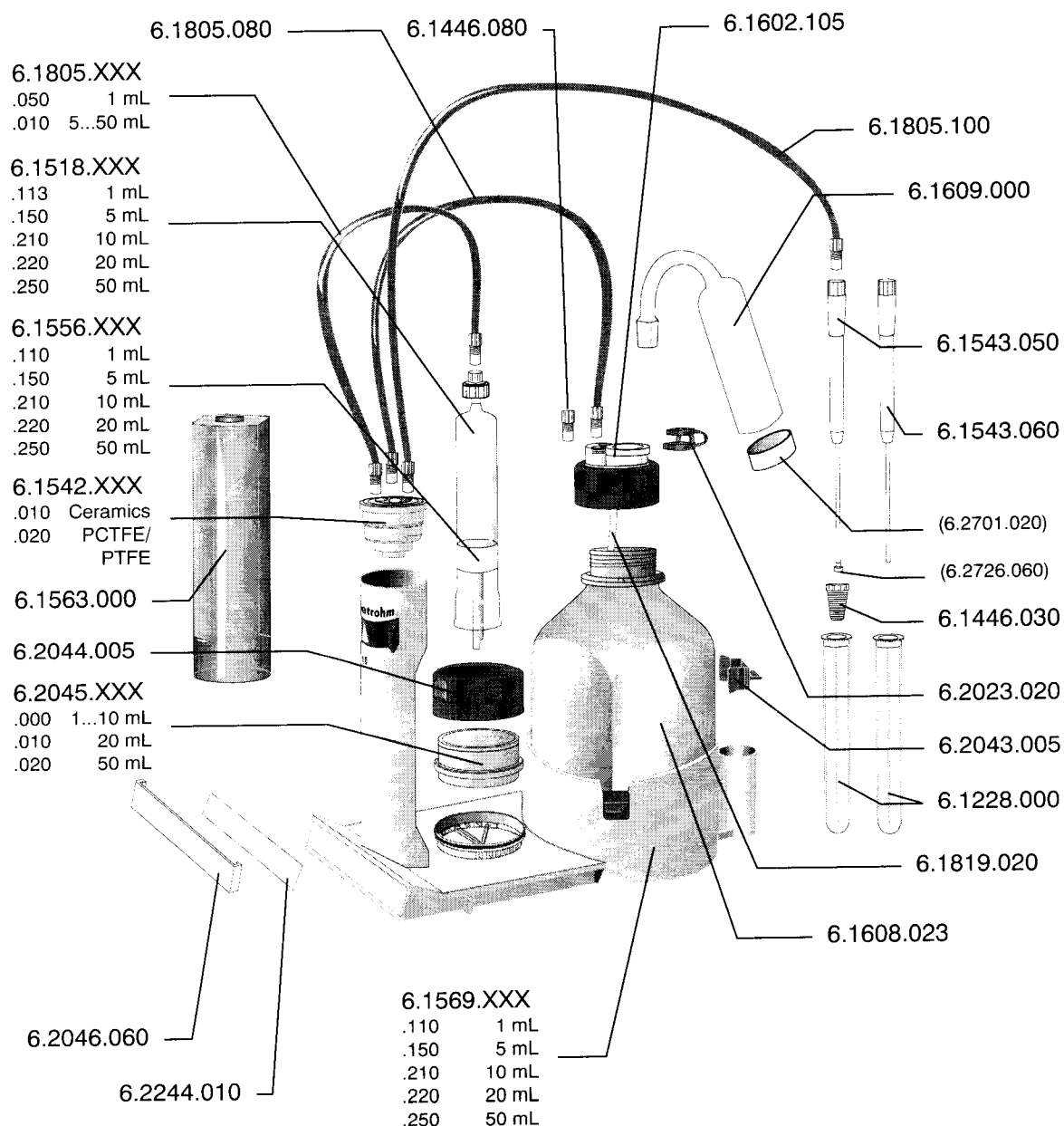


Fig. 6-1: Standard accessories and ordering designations for the 6.3013.XXX and 6.3014.XXX Exchange Units

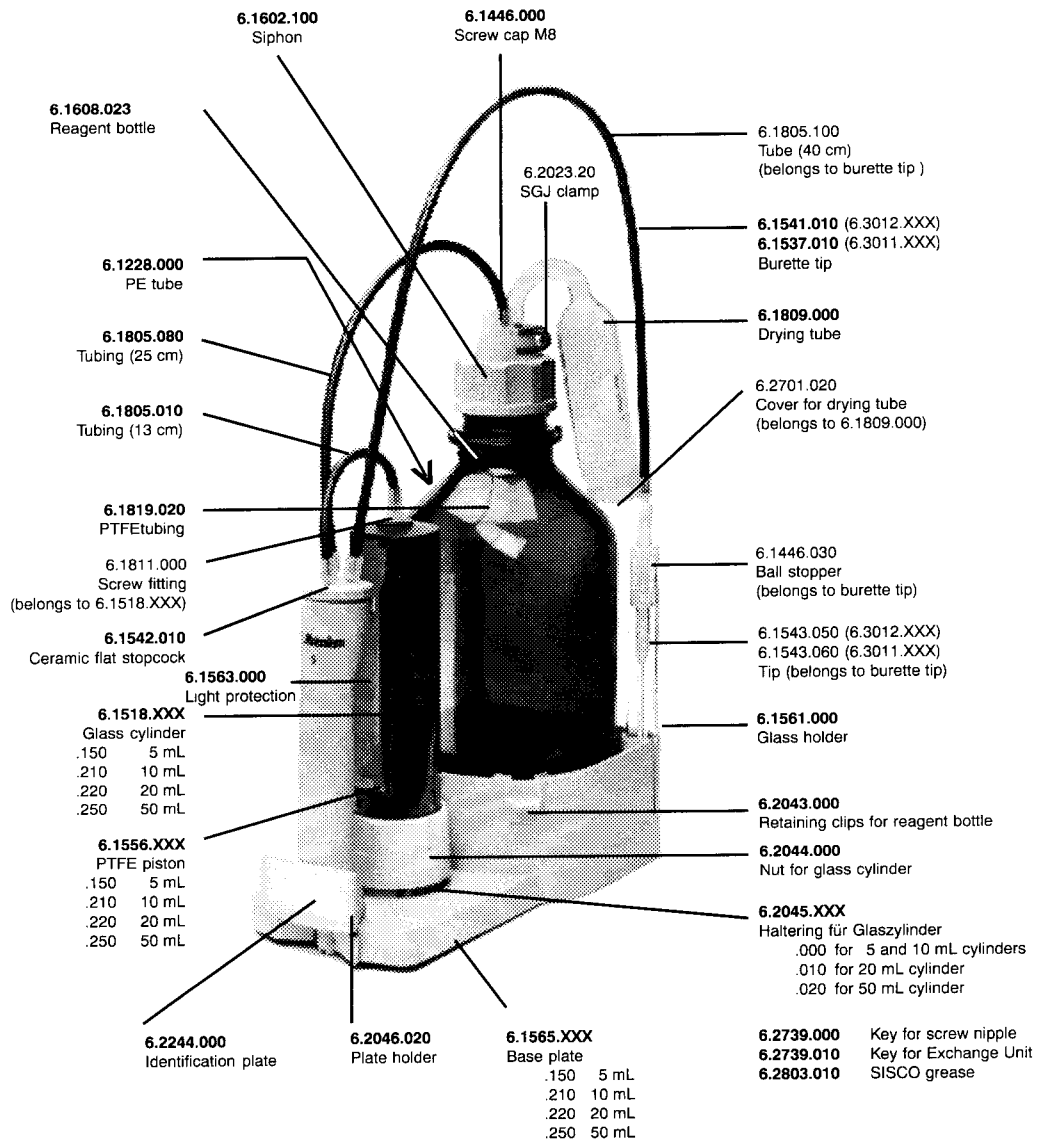


Fig. 6-2: Standard accessories and ordering designations for the 6.3011.XXX and 6.3012.XXX Exchange Units

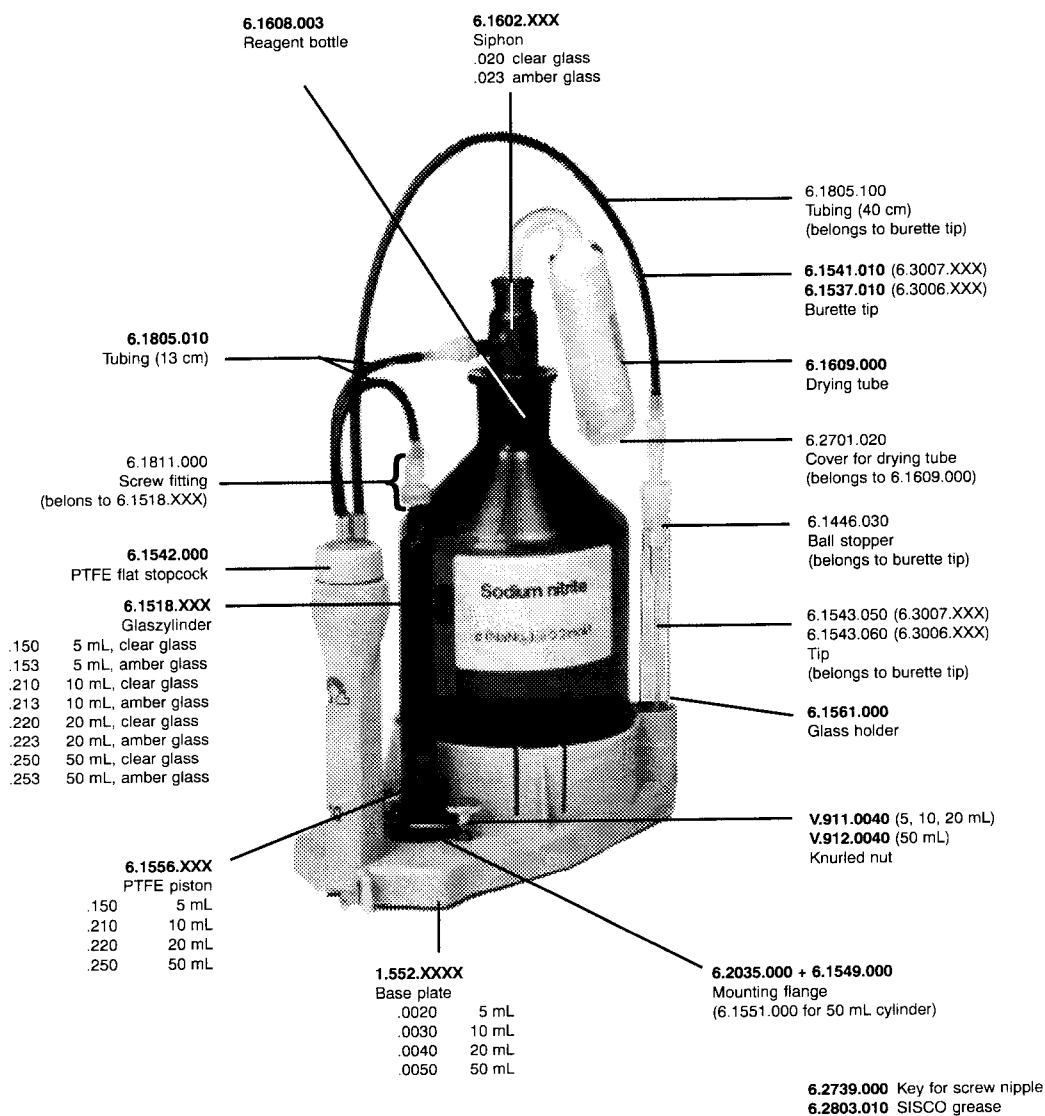


Fig. 6-3: Standard accessories and ordering designations for the 6.3006.XXX and 6.3007.XXX Exchange Units

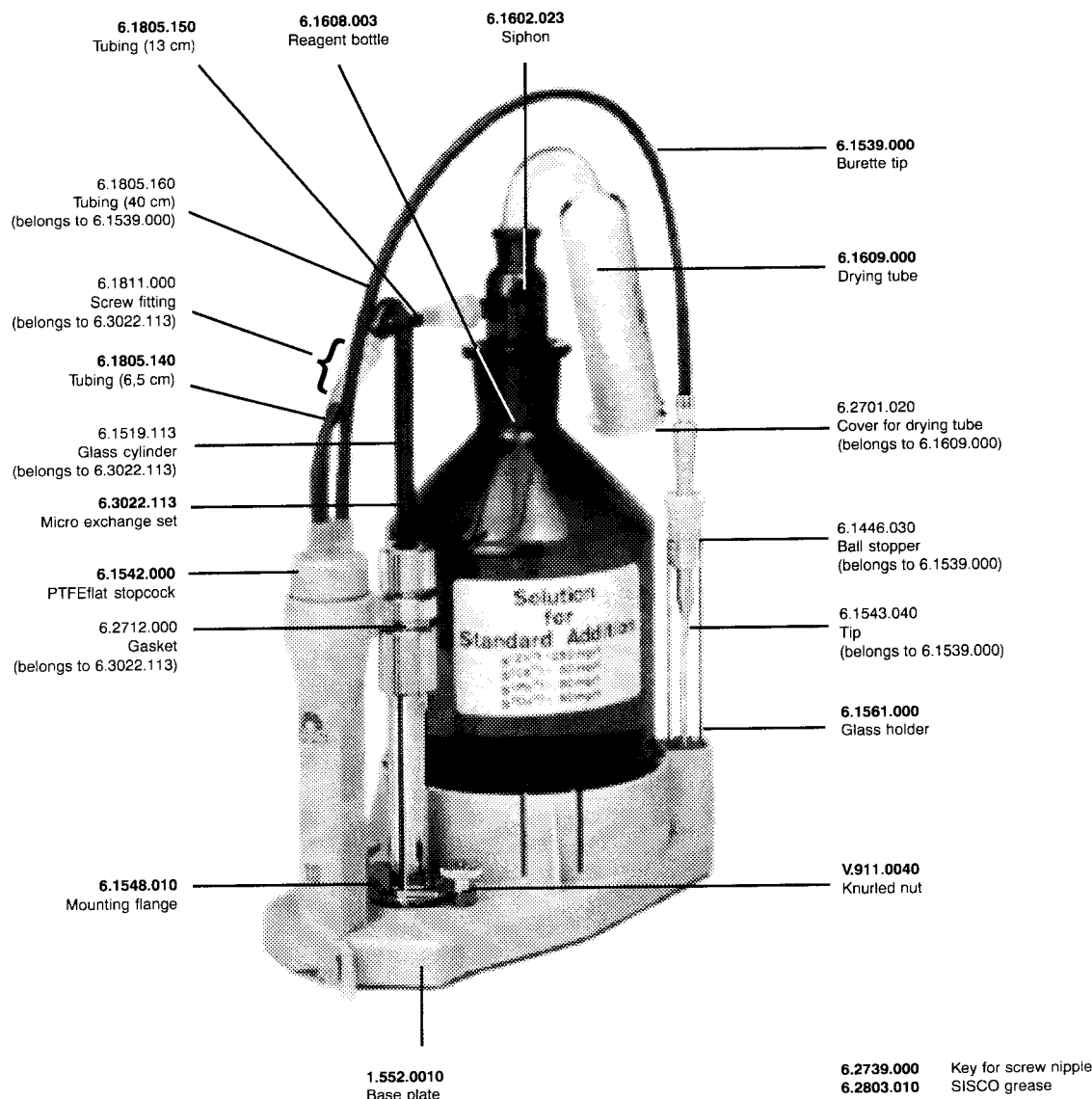


Fig. 6-4: Standard accessories and ordering designations for the 1 mL 6.3006.113 Exchange Unit

### Options for Exchange Units

Accessories to separate order and on payment of extra charge:

#### Bottles and accessories:

|                                                             |            |
|-------------------------------------------------------------|------------|
| Siphon with GL 45 thread (bottles from Riedel de Haën, ...) | 6.1602.120 |
| Siphon with S40 thread (bottles from Merck ...)             | 6.1602.130 |
| Amber glass bottle with GL 45 thread                        | 6.1608.023 |
| Bottle made of PE with thread GL45                          | 6.1608.040 |
| Bottle made of PP with ground-glass joint SGJ 29            | 6.1608.004 |
| Siphon for bottles with SGJ 29                              | 6.1602.023 |
| Thread adapter 32 mm/GL 45                                  | 6.1618.000 |
| Thread adapter 28 mm/GL 45                                  | 6.1618.010 |

**Tubing and accessories:**

The standard screw fitting of the Exchange Units has M6 thread size. On change to M8 thread, the 6.1808.040 Thread Adapter is needed.

|                                                                                   |            |
|-----------------------------------------------------------------------------------|------------|
| Extension tubing with screw nipples, M6 thread                                    |            |
| Length 80 cm                                                                      | 6.1805.110 |
| Length 150 cm                                                                     | 6.1805.030 |
| additional lengths, see Accessories catalogue                                     |            |
| Extension tubing with screw nipples, M8 thread                                    |            |
| Length 50 cm                                                                      | 6.1805.200 |
| Length 25 cm                                                                      | 6.1805.210 |
| Connecting sleeve for tubing extensions (tubing with M6 thread)                   | 6.1808.000 |
| T-connection for tubing with M6 thread                                            | 6.1808.060 |
| T-connection for tubing with M8 thread                                            | 6.1808.070 |
| Coupling with M6 thread and stub for tubing with internal diameter app. 3 mm      | 6.1808.020 |
| Coupling with M8 thread and stub for tubing with internal diameter app. 3 mm      | 6.1808.050 |
| Screw cap, seals tubing with M6 thread together with 6.1808.000 Connecting Sleeve | 6.1446.040 |
| Screw fitting for glass cylinder and tubing with M6 thread                        | 6.1811.000 |
| Screw fitting for glass cylinder and tubing with M8 thread                        | 6.1811.010 |

**Tubing connections with larger internal diameter and M8 thread at Exchange Unit:**

For the connection bottle-stopcock:

|                                                      |            |
|------------------------------------------------------|------------|
| Stopper, M6 thread                                   | 6.1446.040 |
| PTFE tubing                                          | 6.1819.030 |
| Tubing with screw nipples, 25 cm, M8 thread          | 6.1805.210 |
| Thread adapter with M6 outer thread, M8 inner thread | 6.1808.040 |

For the connection stopcock-tip:

|                                                      |            |
|------------------------------------------------------|------------|
| Thread adapter with M6 outer thread, M8 inner thread | 6.1808.040 |
| Tubing with screw nipples, 50 cm, M8 thread          | 6.1805.200 |
| Tip, M8 thread                                       | 6.1543.120 |

**Buret tips:**

|                                  |            |
|----------------------------------|------------|
| Earthing for buret tip           | 6.1808.030 |
| Tip without anti-diffusion valve | 6.1543.060 |
| Tip with anti-diffusion valve    | 6.1543.050 |

**Miscellaneous:**

|                                                                                           |            |
|-------------------------------------------------------------------------------------------|------------|
| Thermostat jacket for 6.3011.XXX ... 6.3014.XXX Exchange Units with M8 thread             | 6.1563.010 |
| PTFE tubing for thermostat jacket, 105 mm                                                 | 6.1819.040 |
| Coupling for thermostat jacket tubing                                                     | 6.1808.050 |
| Coupling for 6.1542.010 ceramic flat stopcock in 6.3006.XXX and 6.3007.XXX Exchange Units | 6.1564.000 |
| SISCO 300 grease, 1 oz. (28.35 g)                                                         | 6.2803.000 |

# Index

Texts which appear in the display are **printed in bold face**. Pages concerning the operation via RS232 interface (green pages) are *printed in italic*.

## A

|                        |                                |
|------------------------|--------------------------------|
| Accessories            |                                |
| - Titrimo              | 201                            |
| - Exchange unit        | 204                            |
| <b>Activate pulse:</b> | 17, 27, 36, 48, 57, 65, 69, 70 |
| <b>action:</b>         | 47, 56, 64                     |
| Analog output          |                                |
| - resolution           | 184                            |
| - calibration          | 169                            |
| - recorder connection  | 184                            |
| Analog potentiometer   | 2                              |
| <b>assign output:</b>  | 48, 57, 65                     |
| Automatic reports      | 78                             |
| <b>Autostart</b>       | 8                              |
| <b>auxiliaries</b>     | 8                              |

## B

|                      |            |
|----------------------|------------|
| <b>Backup</b>        | 86         |
| <b>balance:</b>      | 7          |
| Balance connection   | 182        |
| <b>baud rate:</b>    | 9          |
| Bottle caps          | 188, 207   |
| <b>buffer 1 pH</b>   | 70         |
| Buret                |            |
| - connection         | 180        |
| - preparation        | 188ff      |
| - preselection       | 10, 14, 96 |
| Buret tip            | 208        |
| - storage            | 190        |
| <b>bytes missing</b> | 162        |

## C

|                              |       |
|------------------------------|-------|
| Cables                       | 201   |
| CAL                          | 70    |
| Calculations                 | 74    |
| <cal.data>                   | 88    |
| Calibration sequence         | 71    |
| <b>cal.date</b>              | 88    |
| <b>cal.temp.</b>             | 70    |
| <card>                       | 86    |
| <b>card...</b>               | 162   |
| Card                         | 85    |
| <b>card read/write error</b> | 162   |
| Certificates                 | 199   |
| CE                           | 200   |
| <C-fmla>                     | 75    |
| <b>change card battery</b>   | 162   |
| Characters input             | 6     |
| <b>check drive unit</b>      | 162   |
| <b>check electrode</b>       | 162   |
| <b>check exchange unit</b>   | 162   |
| <b>check T-sensor</b>        | 162   |
| <clear>                      | 4     |
| <b>common variables</b>      | 9, 77 |

|                      |        |
|----------------------|--------|
| Computer connection  | 185    |
| <b>conditioning:</b> | 27, 36 |
| <configuration>      | 7      |
| Configuration        | 7      |
| Connection           |        |
| - balance            | 182    |
| - buret              | 180    |
| - computer           | 185    |
| - electrode          | 187    |
| - printer            | 181    |
| - recorder           | 184    |
| - sample changer     | 183    |
| - stirrer            | 179    |
| - Ti stand           | 179    |
| Connection cable     | 201    |
| Control parameters   |        |
| - DOC                | 67     |
| - KFT                | 38     |
| - SET                | 29     |
| - STAT               | 50     |
| <b>curve:</b>        | 7      |
| Curve                |        |
| - change output      | 153    |
| - examples           | 60, 79 |
| - printing           | 74     |
| <b>cycles DX</b>     | 10     |

## D

|                              |        |
|------------------------------|--------|
| <b>data bit:</b>             | 9      |
| <b>data cycling:</b>         | 92     |
| <b>data lost</b>             | 162    |
| Data                         |        |
| - input                      | 5      |
| - output                     | 78     |
| - reproduction               | 79     |
| Data transfer (RS232)        | 97ff   |
| - problems                   | 161    |
| <b>data set reevaluation</b> | 162    |
| <b>date</b>                  | 8      |
| Decimal places               | 74     |
| Default values               | 126ff  |
| <def>                        | 74ff   |
| <b>delete all:</b>           | 92     |
| <b>delete all silo lines</b> | 92     |
| <b>delete line n</b>         | 91     |
| <b>delete n =</b>            | 16     |
| Delete                       |        |
| - methods                    | 84, 86 |
| - silo lines                 | 91f    |
| - statistic values           | 16     |
| <b>delete silo lines</b>     | 91     |
| <b>delta time</b>            | 45     |
| DET                          | 12     |
| <b>dev.label</b>             | 8      |

|                                 |                |
|---------------------------------|----------------|
| Diagnosis                       | 166            |
| <b>dialog:</b>                  | 8              |
| <b>diam....</b>                 | 10             |
| <b>differential input</b>       | 88             |
| Differential potentiometry      | 187            |
| <b>direction:</b>               | 62             |
| <b>directory...</b>             | 86             |
| <b>directory already exists</b> | 162            |
| <b>disp.crit:</b>               | 54             |
| <b>dispensing type:</b>         | 54             |
| Display, contrast               | 2              |
| <b>display drift:</b>           | 78             |
| <b>display rate</b>             | 48, 65         |
| <b>disp.time</b>                | 54             |
| <b>division by zero</b>         | 163            |
| DOC                             | 61             |
| DOS                             | 54             |
| <DOS>                           | 2              |
| <b>dos.drive:</b>               | 10             |
| <b>dos.element:</b>             | 10, 14         |
| Dosimat                         |                |
| - connection                    | 180            |
| - preselection                  | 10, 14, 96     |
| Dosing                          | 2, 54ff, 96    |
| <b>dos.rate</b>                 | 10, 13         |
| Drift                           | 18, 30         |
| <b>drift corr:</b>              | 27, 36         |
| <b>drift value</b>              | 27, 36         |
| <b>dynamics</b>                 | 22, 32, 42, 61 |

## E

|                        |          |
|------------------------|----------|
| Earthing socket        | 3        |
| <b>edit silo lines</b> | 91       |
| <b>electr.id</b>       | 88       |
| Electrode connection   | 187      |
| <b>electrode test:</b> | 14       |
| <b>end at:</b>         | 61       |
| <enter>                | 4        |
| Entry of               |          |
| - numbers              | 5        |
| - text                 | 6        |
| <b>EP at...</b>        | 22, 42   |
| EPC                    | 6        |
| <b>EP overflow</b>     | 163      |
| <b>EP recongition:</b> | 16       |
| EP titration           | 22ff     |
| Error messages         | 102, 162 |
| <b>evaluation</b>      | 16, 46   |
| Evaluation             | 18, 53   |
| Exchange unit          | 188ff    |
| <b>external DX</b>     | 96       |
| <b>extr.time</b>       | 24, 32   |

## F

|                       |            |
|-----------------------|------------|
| Fabrication number    | 3          |
| <b>Factor</b>         | 13, 15, 45 |
| Filling rate          |            |
| - after determination | 15         |
| - after manual dosing | 2          |
| Filling times         | 58         |
| <b>fix EP</b>         | 17         |
| <b>fix time</b>       | 46         |
| <b>fix-V</b>          | 46         |
| <b>formula</b>        | 74         |

## G

|                                   |      |
|-----------------------------------|------|
| General rules for operating RS232 | 97ff |
| Graphic                           |      |
| - change output                   | 153  |
| - printing                        | 78   |

## H

|                    |       |
|--------------------|-------|
| <b>Handshake:</b>  | 9     |
| Handshake          | 155ff |
| Hardware handshake | 157   |

## I

|                    |       |
|--------------------|-------|
| <b>id#1 or C21</b> | 89    |
| Identification     | 89    |
| - request          | 17    |
| <b>info</b>        | 81    |
| <b>internal D0</b> | 96    |
| Initial values     | 126ff |
| Input of           |       |
| - numbers          | 5     |
| - text             | 6     |
| Inquiries          | 5     |
| I/O lines          | 194   |
| <b>I(pol)</b>      | 14    |
| ISO                | 199   |

## K

|                   |       |
|-------------------|-------|
| Keycode           | 168   |
| Keypad            | 4     |
| Keys              |       |
| - <cal.data>      | 88    |
| - <card>          | 86    |
| - <C-fmla>        | 74    |
| - <clear>         | 4     |
| - <configuration> | 7     |
| - <def>           | 74ff  |
| - <DOS>           | 2, 96 |
| - <enter>         | 4     |
| - <meas/hold>     | 4     |
| - <mode>          | 11    |
| - <parameters>    | 12ff  |
| - <prep>          | 96    |
| - <print>         | 80    |
| - <QUIT>          | 4     |
| - <reports>       | 80    |
| - <select>        | 4     |
| - <silo>          | 90    |
| - <smpl data>     | 89ff  |
| - <START>         | 2, 4  |
| - <statistics>    | 4, 76 |
| - <STOP>          | 2, 4  |
| - <user meth>     | 84    |
| KFT               | 32    |

## L

|                   |                |
|-------------------|----------------|
| <b>L4 output:</b> | 48, 57, 65, 81 |
| <b>L6 output</b>  | 81             |
| LED               | 2              |
| <b>len....</b>    | 10             |
| <b>limit</b>      | 163            |
| Lock keyboard     | 150            |
| <b>low limit</b>  | 17, 47, 56, 64 |

## M

|                              |                |
|------------------------------|----------------|
| Mains                        |                |
| - connection                 | 3              |
| - tension                    | 3              |
| Malfunctions                 | 161ff          |
| Manual operation             | 4ff            |
| manual stop                  | 163            |
| match id                     | 94             |
| max.rate                     | 22, 33, 42, 61 |
| mean n =                     | 16             |
| Mean values                  |                |
| - calculation                | 76             |
| - delete results             | 16             |
| - display                    | 80             |
| - report                     | 80             |
| MEAS                         | 68             |
| <meas/hold>                  | 4              |
| meas.input:                  | 14             |
| meas.lim                     | 163            |
| measuring parameters         | 68             |
| Measuring point list         | 52             |
| meas.mode:                   | 56, 73         |
| meas out of limit            | 163            |
| meas.val:                    | 47, 64         |
| meas.pt.density              | 12             |
| meas.pt list overflow        | 163            |
| Memory card                  | 85             |
| MET                          | 12             |
| method:                      | 81, 91         |
| Method name                  | 84, 86         |
| method recall, delete, store | 84, 86         |
| min.incr.                    | 12             |
| min.rate                     | 22, 33, 42, 61 |
| min.volume incr.             | 34             |
| missing EP                   | 163            |
| missing fix V                | 163            |
| missing fix time             | 163            |
| <mode>                       | 11             |
| Mode                         |                |
| - CAL                        | 70             |
| - DET                        | 12             |
| - DOC                        | 61             |
| - DOS                        | 54             |
| - KFT                        | 32             |
| - MEAS                       | 68             |
| - MET                        | 12             |
| - SET                        | 22             |
| - STAT                       | 42             |
| - TIP                        | 72             |
| Mode selection               | 11             |
| monitoring                   | 47, 56, 64     |

## N

|                         |     |
|-------------------------|-----|
| no end set              | 163 |
| No.EP not corresponding | 164 |
| no EP set               | 163 |
| no meas.quantity        | 163 |
| no memory card          | 163 |
| no method               | 163 |
| Non-aqueous titration   | 187 |
| no new com.var.         | 163 |
| no new mean             | 163 |
| no new silo result      | 163 |
| no new temp.var.        | 163 |
| no sequence             | 163 |
| no titration data       | 163 |
| not possible            | 163 |
| not valid               | 163 |

## O

|                       |     |
|-----------------------|-----|
| Object tree           | 106 |
| Ordering designations | 201 |
| outlet:               | 10  |
| Outputs               | 194 |
| outside               | 163 |
| overrange             | 164 |

## P

|                     |                             |
|---------------------|-----------------------------|
| Parameters          |                             |
| - CAL               | 70                          |
| - DET               | 12                          |
| - DOC               | 61                          |
| - DOS               | 54                          |
| - KFT               | 32                          |
| - MEAS              | 68                          |
| - MET               | 12                          |
| - Prep              | 9                           |
| - SET               | 22                          |
| - STAT              | 42                          |
| - TIP               | 72                          |
| <parameters>        | 12ff                        |
| parity:             | 9                           |
| pause (X)           | 14, 23f, 32, 43, 54, 62, 81 |
| peripheral units    | 7                           |
| pH(as)              | 88                          |
| Pin assignments     |                             |
| - "Remote" socket   | 194                         |
| - RS232 C           | 159                         |
| pK/HNP:             | 17                          |
| Power               |                             |
| - connection        | 3                           |
| - mains switch      | 3                           |
| - tension           | 3                           |
| power on prep:      | 9                           |
| prep.               | 81                          |
| prep....            | 164                         |
| prep.dosing element | 9                           |
| preselection        | 17                          |
| <print>             | 78                          |
| Printer             |                             |
| - connection        | 181                         |
| - problems          | 161                         |
| - selection         | 7                           |
| <prep>              | 96                          |
| Problems            |                             |
| - KFT titrations    | 41                          |
| - printer           | 161                         |
| - SET titrations    | 31                          |
| - STAT              | 50                          |
| program             | 8                           |

## Q

|        |   |
|--------|---|
| <QUIT> | 4 |
|--------|---|

## R

|                         |         |
|-------------------------|---------|
| RAM, initialising       | 176     |
| rate                    | 47, 164 |
| rate out of limit       | 164     |
| rate too high           | 164     |
| rate too low            | 164     |
| rates not corresponding | 164     |
| Recorder                |         |
| - calibration           | 169     |
| - connection            | 184     |

|                                   |        |                                                     |                        |
|-----------------------------------|--------|-----------------------------------------------------|------------------------|
| <b>reload</b> .....               | 87     | <b>Setting up</b> .....                             | 179ff                  |
| Reload measuring point list ..... | 145    | <b>signal drift</b> .....                           | 13                     |
| Remote control .....              |        | <b>&lt;sil0 &gt;</b> .....                          | 90                     |
| - via "Remote" lines .....        | 194    | <b>sil0 calculation</b> .....                       | 93                     |
| - via RS232 .....                 | 97ff   | <b>sil0 empty</b> .....                             | 164                    |
| <b>report:</b> .....              | 9, 78  | <b>sil0 full</b> .....                              | 164                    |
| Report .....                      |        | <b>sil0 lines</b> .....                             | 91                     |
| - output .....                    | 78     | Silo reports .....                                  | 93ff                   |
| - printing .....                  | 78, 80 | <b>slope</b> .....                                  | 88                     |
| - reproduction .....              | 80     | <b>&lt;smpl data &gt;</b> .....                     | 89ff                   |
| - selection .....                 | 78     | <b>smpl size, unit:</b> .....                       | 89                     |
| <b>&lt;reports &gt;</b> .....     | 4, 80  | Software handshake .....                            | 155                    |
| <b>req.ident:</b> .....           | 17     | Special messages .....                              | 162                    |
| <b>req.smpl size:</b> .....       | 17     | <b>&lt;START &gt;</b> .....                         | 2, 4                   |
| <b>RS control:</b> .....          | 9      | <b>start at...</b> .....                            | 61                     |
| <b>res.Tab:</b> .....             | 16     | <b>start delay</b> .....                            | 8                      |
| Result .....                      |        | <b>start pH</b> .....                               | 43                     |
| - calculation .....               | 74     | <b>start rate</b> .....                             | 44                     |
| - delete .....                    | 16     | <b>start time</b> .....                             | 43                     |
| - display .....                   | 80     | <b>start V</b> .....                                | 13                     |
| - report .....                    | 78     | Start volume .....                                  | 13                     |
| - store .....                     | 93     | STAT .....                                          | 42                     |
| - text .....                      | 78     | <b>&lt;statistics &gt;</b> .....                    | 4, 76                  |
| Rolling inquiries .....           | 5      | <b>statistic</b> .....                              | 16                     |
| <b>RS1 decimal places</b> .....   | 74     | Statistics calculations .....                       | 76                     |
| <b>RS1 text</b> .....             | 74     | Statistics values .....                             |                        |
| <b>RS1 unit:</b> .....            | 74     | - delete results .....                              | 16                     |
| <b>RS232 settings</b> .....       | 9      | - report .....                                      | 80                     |
| RS232 interface .....             |        | Stirrer connection .....                            | 179                    |
| - characteristics .....           | 155ff  | <b>&lt;STOP &gt;</b> .....                          | 4                      |
| - configuration .....             | 9      | <b>stop...</b> .....                                | 15                     |
| - RS control .....                | 97ff   | <b>stop bit:</b> .....                              | 9                      |
| - pin assignment .....            | 159    | <b>stop conditions</b> .....                        | 15, 26, 34, 45, 55, 63 |
| <b>run number</b> .....           | 8      | <b>stop crit.:</b> .....                            | 22, 33                 |
|                                   |        | Stop criterion .....                                | 15, 22, 33, 45         |
| <b>S</b>                          |        | <b>stop drift</b> .....                             | 22, 33                 |
| <b>same buffer</b> .....          | 164    | <b>stop... reached</b> .....                        | 164                    |
| <b>save lines:</b> .....          | 92     | <b>stop rate</b> .....                              | 45                     |
| <b>save lines off</b> .....       | 164    | <b>stop time</b> .....                              | 22, 33, 45             |
| Sample changer .....              | 183    | Stop times (STAT) .....                             | 51                     |
| <b>sample changer:</b> .....      | 70     | <b>stop V</b> .....                                 | 15                     |
| Sample identification .....       | 89     | Store .....                                         |                        |
| Sample size .....                 | 89     | - methods .....                                     | 84, 86                 |
| Scope of delivery .....           |        | - results .....                                     | 92                     |
| - Titrino .....                   | 201    | Submethods in TIP .....                             | 81                     |
| - Exchange unit .....             | 204    | Survey .....                                        | 2                      |
| <b>second TIP call</b> .....      | 164    | <b>sweep time</b> .....                             | 61                     |
| <b>&lt;select &gt;</b> .....      | 4      | <b>system error 3</b> .....                         | 164                    |
| Selection of balance .....        | 7      |                                                     |                        |
| <b>send to:</b> .....             | 7      | <b>T</b>                                            |                        |
| Sequence .....                    |        | Technical specifications .....                      | 192                    |
| - CAL .....                       | 71     | <b>t(delay)</b> .....                               | 23, 34, 45             |
| - DET .....                       | 18     | <b>temp.</b> .....                                  | 88, 165                |
| - DOC .....                       | 66     | <b>temperature</b> . 14, 25, 33, 44, 54, 63, 68, 73 |                        |
| - DOS .....                       | 58     | <b>temperature:</b> .....                           | 47, 56, 65             |
| - KFT .....                       | 37     | <b>temporary variables</b> .....                    | 81                     |
| - MET .....                       | 18     | <b>temp.out of limit</b> .....                      | 165                    |
| - SET .....                       | 28     | Text input .....                                    | 6                      |
| - STAT .....                      | 49     | Thermostatic jacket .....                           | 190                    |
| - TIP .....                       | 82     | <b>time</b> .....                                   | 8                      |
| Serial number .....               | 3      | <b>time interval</b> .....                          | 44, 54, 6              |
| SET .....                         | 22     | TIP .....                                           | 72                     |
| SET 1 .....                       | 22     | <b>TIP terminated</b> .....                         | 165                    |

|                        |                 |
|------------------------|-----------------|
| Titration              |                 |
| - problems             | 31, 41, 50, 187 |
| - vessel               | 186             |
| Titration curve        |                 |
| - change output        | 153             |
| - printing             | 78              |
| Titration modes        | 11              |
| Titration parameters   |                 |
| - DET                  | 18              |
| - DOC                  | 61              |
| - KFT                  | 37              |
| - MET                  | 18              |
| - SET                  | 22              |
| - STAT                 | 42              |
| Titration sequence     |                 |
| - DET                  | 18              |
| - DOC                  | 66              |
| - KFT                  | 37              |
| - MET                  | 18              |
| - SET                  | 28              |
| - STAT                 | 49              |
| - TIP                  | 82              |
| <b>titr.direction:</b> | 23, 32, 44      |
| <b>titr.rate</b>       | 12              |
| Tree                   | 106ff           |
| Trigger                | 99              |
| Tubes                  | 208             |

## U

|                 |                |
|-----------------|----------------|
| Unit            |                |
| - result        | 74             |
| - sample        | 89             |
| <b>up limit</b> | 17, 47, 56, 64 |
| <b>U(pol)</b>   | 14             |
| <user meth >    | 84             |
| User methods    | 84ff           |

## V

|                    |    |
|--------------------|----|
| Values input       | 5  |
| <b>V increment</b> | 12 |
| <b>volume</b>      | 54 |
| <b>volume DX</b>   | 10 |

## W

|                         |     |
|-------------------------|-----|
| <b>waiting time</b>     | 13  |
| <b>warn.interv.DX</b>   | 10  |
| Warranty                | 198 |
| Weight                  | 89  |
| <b>wrong card (XXX)</b> | 165 |
| <b>wrong sample</b>     | 165 |