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719 S Titrino

Program version 5.719.0021

Instructions for Use

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Table of contents

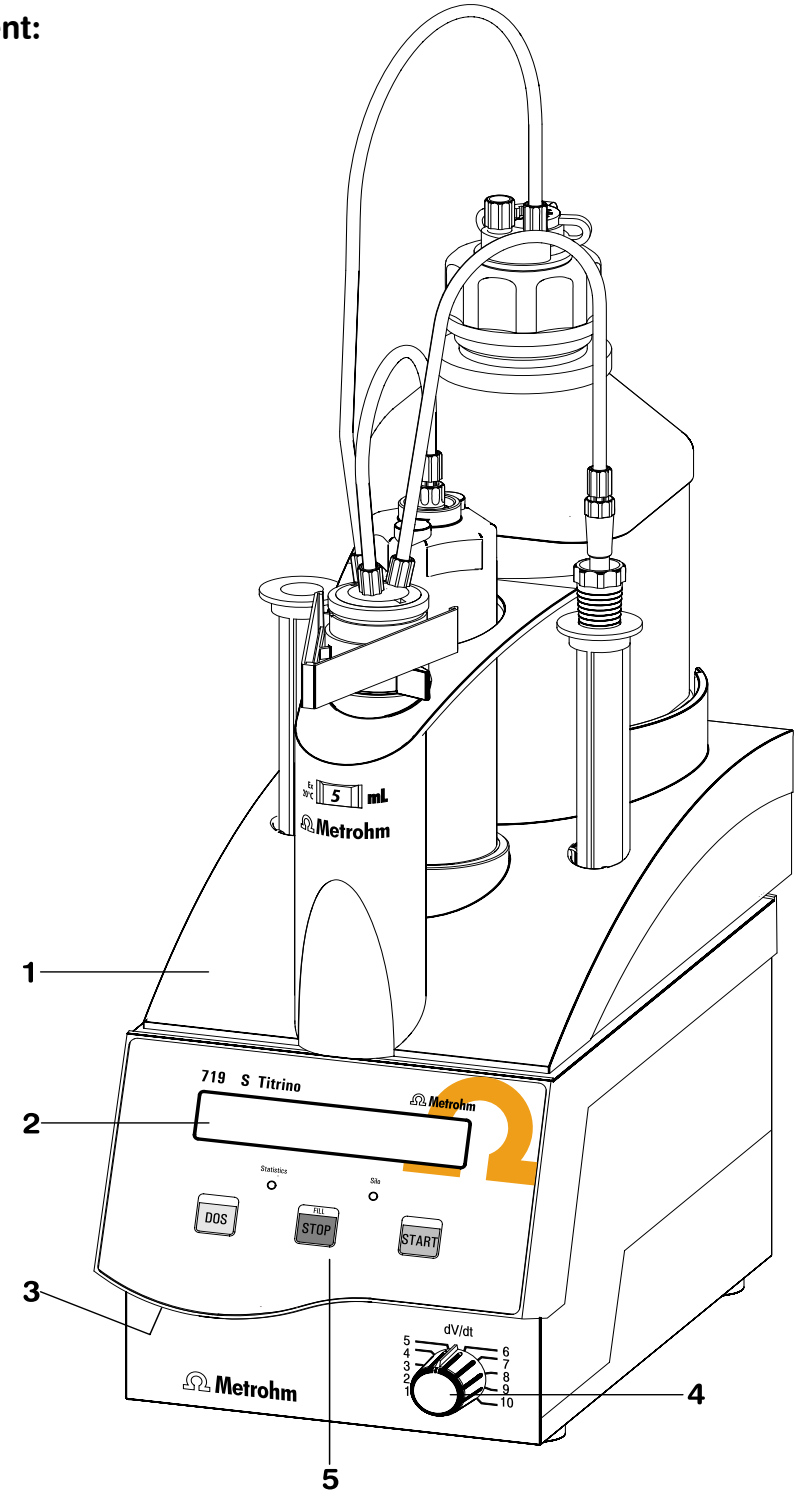
1 Introduction

1.1 Instrument description

The 719 S Titrino is a titrator to perform fast and precise endpoint titrations.
Ready-to-start methods for the most common applications are stored in the internal method memory. The operator is free to modify and overwrite this methods or to create and store his own titration sequences.
Data exchange with a PC is possible with the Metrodata VESUV Software and with Metrodata TiNet Software complete remote control, data acquisition and evaluation via PC is enabled.

1.2 Controls and parts

Front view of instrument:



1 Exchange Unit

2 Display

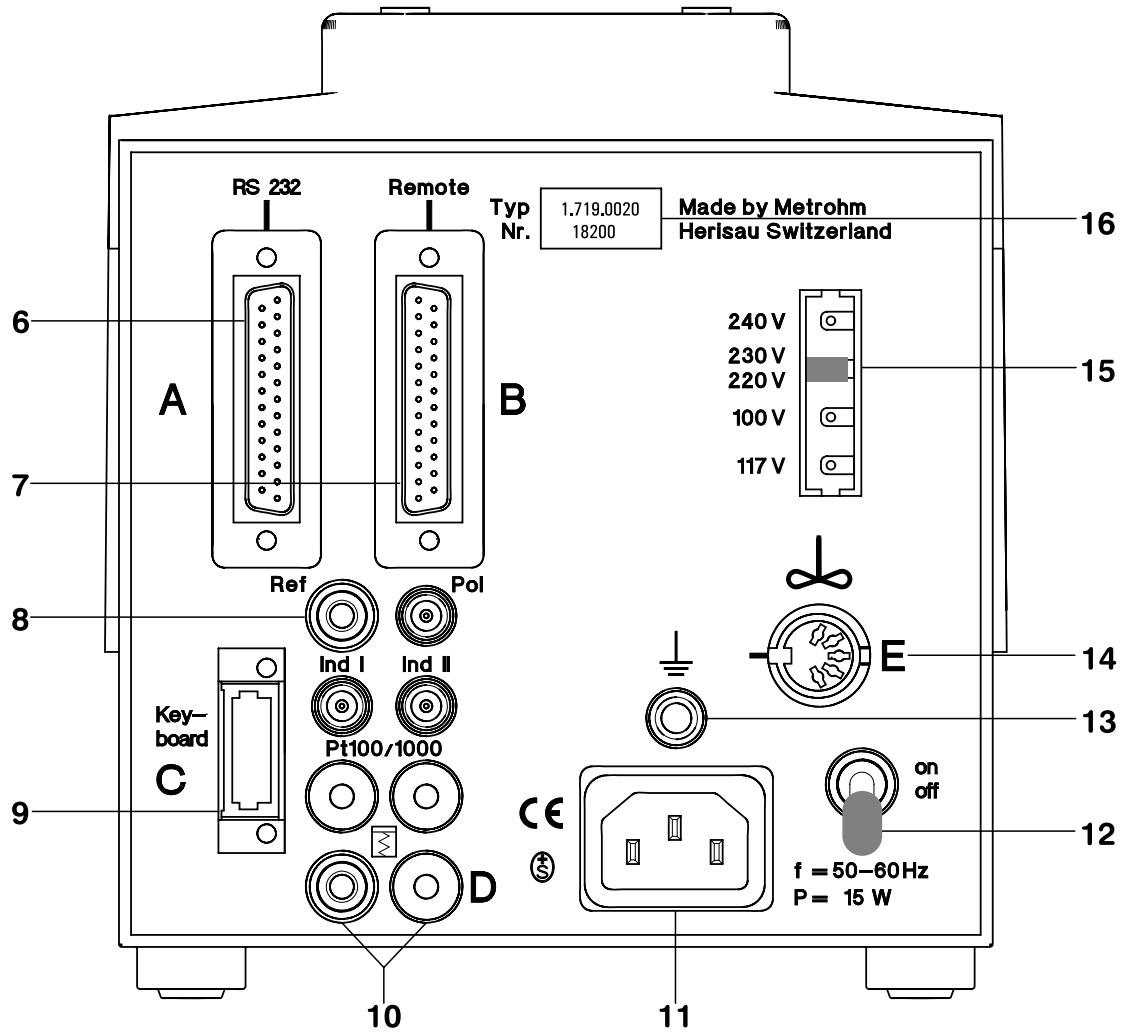
3 Setting of display contrast

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

5 Control keys and indicator lamps on the Titrino

Key <DOS>	Dosing key. Dispensing is performed as long as <DOS> is being pressed. Used e.g. to prepare the Exchange Unit. The dispensing rate can be set with potentiometer (**4**).
Key <STOP/FILL>	- Stops procedures, e.g. titrations, conditioning. - Filling after manual dosing with <DOS>.
Key <START>	Starts procedures, e.g. titrations, conditioning. Identical with key <START> of the separate keypad.
Indicator lamps:	
"Statistics"	Lamp is on when the "statistics" function (calculation of mean and standard deviation) is on.
"Silo"	Lamp is on when silo memory (for sample data) is on.

Rear view of instrument:



6 **RS232 interface**
for the connection of printer, balance or a computer

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

8 **Connection of electrodes and temperature sensor**

- 2 high-impedance measuring inputs for pH and U measurements (Ind I/ Ind II). They can either be used separately or for differential potentiometry, see page 124.
  Important: If you work with both measuring inputs in the same vessel, the same reference electrode must be used.
- 1 measuring input for polarized electrodes (Pol).
- 1 measuring input for PT100 or Pt1000 temperature sensor.

9 **Connection for separate keypad**

10 **Analog output for the connection of a recorder**

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

12 **Mains switch**

13 **Earthing socket**

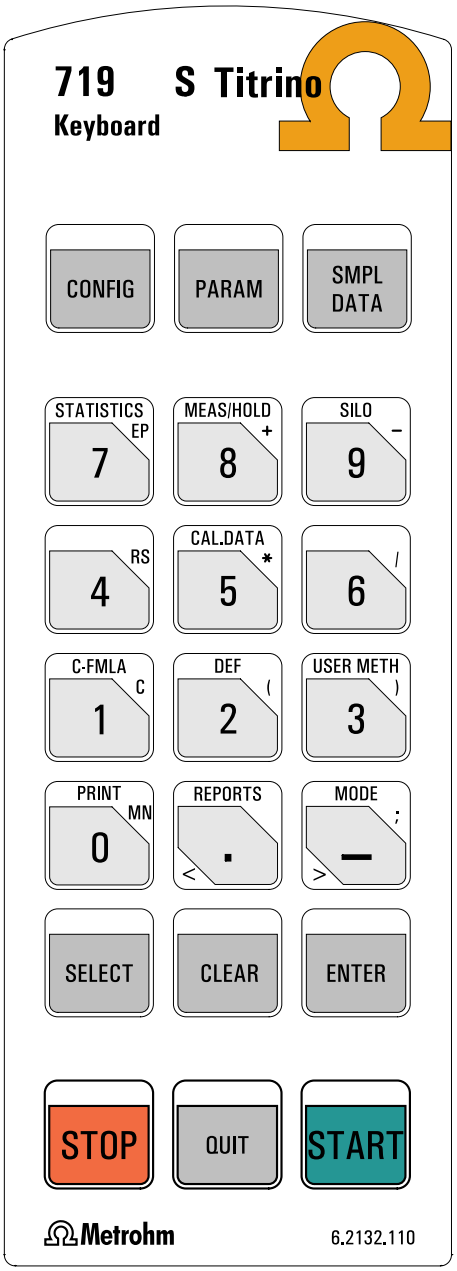
14 **Connection for stirrer**
728 Magnetic Stirrer, 802 Rod Stirrer, 703 or 727 Ti Stand
Supply voltage: 9 VDC ($I \leq 200$ mA)

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

16 **Rating plate**
with fabrication, series and instrument number

2 Manual operation

2.1 Keypad



CONFIG	Configuration.
PARAM	Parameters.
SMPL DATA	Sample data.
STATISTICS	ON/OFF switching of statistics calculations of consecutive determination, see page 41.
MEAS/HOLD	ON/OFF switching of measurements between titrations and hold during titrations.
SILO	ON/OFF switching of silo memory for sample data, see page 51.
CAL.DATA	Calibration data, see page 49.
C-FMLA	Calculation values, see page 40.
DEF	Formulas, data output, see page 39ff.
USER METH	Management of internal method memory, see page 47.
PRINT	Printing of reports, see page 44.
REPORTS	Result output.
MODE	Mode selection, see page 24.
<,>	Keys for text input.
SELECT	Selection of special values (dialog marked with ":")
CLEAR	Clears values, set special values.
ENTER	Stores values.
STOP	Stops methods.
QUIT	Quits inquiries, waiting times, printing.
START	Starts methods.

The third functions (inscriptions in the triangle) on the keys of the keypad are used for formula entry, see page 39.

2.2 Principle of data input

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

```
configuration
>peripheral units
```

- In our example you are in the menu "configuration" on the title ">peripheral units". By pressing <CONFIG> you can move to the other titles of this menu.

- If a dialog text is marked with ">", it contains a group of inquiries. You branch into this group by pressing <ENTER>.
  Example inquiries of "peripheral units":
  The first line indicates again where you are.
  If a dialog text of an inquiry is marked with ":", you can select a value with the key <SELECT>.

```
>peripheral units
send to:              IBM
```

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

- Repeated pressing of <ENTER> moves you through the inquiries of the group ">peripheral units“, after the last inquiry of this group you leave this group and return to the level above.
  The next group of the menu "configuration“ appears: ">auxiliaries“

```
configuration
>auxiliaries
```

- With key <QUIT> you leave an inquiry or a group of inquiries, it always moves you one level up.

- In this example you leave the menu "configuration" by pressing <QUIT> and return to the display of titration mode and the chosen method.

```
SET pH              ********
```

2.3 Text input

Example storing a method:

<USER METH>

```
user methods
>recall method
```

- Press key <USER METH>, the group ">recall method" appears.

<USER METH>
<ENTER>

```
>store method
method name:
```

- Choose ">store method" by pressing <USER METH> and press <ENTER>.
  The name of the method which is currently in the working memory is displayed.

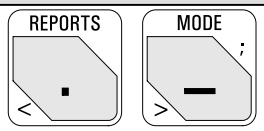
<CLEAR>

- Delete this name with <CLEAR>.

<<>

- Open the "text writing mode" with key <<>.

```
>store method
method name:      ABCDEFG
```



- Select the character marked by the blinking cursor with the Keys <<> and <>>, confirm it with <ENTER>. Select the next character...

  When you confirmed the last character, i.e. your name is complete, you quit the text writing mode with <QUIT>.
  Confirm now the name with <ENTER>.

  If your text fills the whole text field, just press <ENTER> to store the text.

<QUIT>
<ENTER>

```
>store method
method name:          text
```

- During text input you can correct typing errors with <CLEAR>:
  <CLEAR> deletes the characters one by one.

- If you wish to modify an existing name (e.g. if you have names like Text 1, Text 2, Text 3), do not delete the existing name before you start the text input mode. Proceed then as follows:
  1. Press <USER METH>, place the cursor to ">store method" and press <ENTER>.
  2. Open the text writing mode directly: Press key <<>.
  3. <CLEAR> now deletes the characters one by one or you can add additional characters.

2.4 Tutorial

This short operating course teaches you to work quick and efficient with the 719 S Titrino, by means of the most important applications.

Set up your Titrino and connect the peripheral devices needed, see chapter 5.

2.4.1 Entering data, setting the dialog language

We can thus make a start and first take a look at the fundamentals of the entry of data. We change the dialog language.

```
SET pH            ********
```

- Switch on the Titrino. It is now in the standby state, it shows you the active mode and method name.

<CONFIG>

- Press the key <CONFIG>, the display shows:

```
configuration
>peripheral units
```

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

<CONFIG>

- Press again <CONFIG>. You see the title of a new group of inquiries.

```
configuration
>auxilliaries
```

This "auxiliaries" group contains the inquiry for the dialog language.

<ENTER>

- Pressing the <ENTER> key takes you to the inquiries of the group "auxiliaries". Note the ">" sign. All titles of inquiry groups are prefixed by this sign.

```
>auxilliaries
dialog:           english
```

This is the first inquiry of the "auxiliaries" group: the selection of the dialog language.

<SELECT>

- You select the various dialog languages with the <SELECT> key. Press <SELECT> repeatedly until "español" appears in the display.
  Note the sign ":". It appears if the values can be selected with the key <SELECT>.

```
>auxilliaries
dialog:           español
```

<ENTER>

- Accept the new "value" with <ENTER>.
  The next inquiry "fecha" (date) of the group "ajustes varios" (auxiliaries) is shown.

```
>ajustes varios
fecha          2002-03-13
```

You can open this inquiry by pressing <ENTER> too and go through all the inquiries of this group this way.

Because this inquiry follows no colon ":" the value can't be selected by <SELECT>, the date "fecha" has to be entered with the numeric keys.

<QUIT>

- Exit the inquiries with <QUIT>. You are one level higher in the "configuration" menu showing the title "ajustes varios" (auxiliaries).

```
configuration
>ajustes varios
```

<QUIT>

- Press <QUIT> once again to exit the "configuration" menu and return to the standby state.

```
SET pH              ********
```

All the dialog texts will now be displayed in Spanish. If you prefer English as the displayed dialog language, proceed as before and select "English".

2.4.2 Development of a method, titration of an acid

Selection of the mode

<MODE>

```
mode
mode                    SET
```

- Press <MODE> repeatedly until "SET" appears in the display. For a description of the SET mode see page 30ff.

<ENTER>

```
SET pH              ********
SET:                    pH
```

- Confirm "SET" with <ENTER>

4 × <SELECT>

- Now select the measured quantity: Press <SELECT> repeatedly until "pH" appears again in the display.
  Confirm the measured quantity "pH" with <ENTER>.

```
SET pH              ********
```

Now set the end point.

Entry of the end point and the control parameters

<PARAM>

```
parameters
>SET1
```

- Press <PARAM>. The display shows:

Control parameters for EP1

<ENTER>

```
>SET1
EP at pH                OFF
```

```
>SET1
EP at pH              7.00
```

- Set the end point to pH = 7.00.

<ENTER>

```
>SET1
dynamics                OFF
```

```
>SET1
dynamics                 3
```

- Dynamics means the control range in which the adding of the titrant is controlled in dependence on the measured value (OFF: largest control range, i.e. slow titration).
  Set the range to 3. I.e. 3 pH units before the set EP controlled dosing starts.

<ENTER>

```
>SET1
max.rate       10.0 ml/min
```

Maximum possible titration rate inside the control range.

<ENTER>

```
>SET1
min.rate        25.0µl/min
```

Minimum titration rate inside the control range.

2 × <QUIT>

- Quit the inquiry with <QUIT>.

For the titration put a Exchange Unit with *c*(NaOH) = 0.1 mol/L on the Titrino and rinse the tubing and the buret Tipp with <DOS>. Fill the buret again with <STOP/FILL>.
Plug a combined pH glass electrode into measuring input 1 (Ind I).
Pipette 2 mL *c*(HCl) = 0.1 mol/L into your titration vessel, dilute with ca. 20 mL dist. water.
Put a magnetic stirrer in the titration vessel and place buret tip and electrode in the probe, see page 126 for their arrangement.
Start the stirrer and press <START>

During the titration the first line of the display shows the current measured value and the volume already dispensed. The second line shows a "control bar", which indicates the control deviation of the current measured value from the set end point.

```
pH 2.67              0.351 ml
#======
```

After the titration the end point volume and its pH value is displayed.

With this end point a result can be calculated:

Calculation of the result: formula entry

With this equivalence point a result can be calculated.

<DEF>

- Press the <DEF> key.

```
def
>formula
```

<ENTER>

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

```
RS?
```

<1>

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

```
RS1=
```

You now can enter a formula. Note here the top inscription on the keys of the keypad and the numbers. The following symbols can be used:

EP# EP's with 1-digit number, e.g. EP1.
RS# Previously calculated results, e.g. RS1 in the second formula.
C## Calculation constant with 2-digit number, e.g. C01. C00 is reserved for the sample size. For the meaning of the calculation constants see page 40.

```
RS1=EP1*C01*C02/C00
```

<ENTER>

Calculate the content of your hydrochloric acid in g/L:
RS1=EP1*C01*C02/C00
End point*conc.(titrant)*molecular weight/sample size
To correct a formula, delete it with <CLEAR>.

- Confirm the formula with <ENTER>.

```
>formula
RS1 text                RS1
```

- You may enter a text for the result output, see page 8.

```
>formula
RS1 decimal places       2
```

- Enter the desired number of decimal places for the result.

```
>formula
RS1 unit                 %
```

- Select the desired unit g/L with <SELECT>, or type a text as unit, see page 8.

<SELECT>
<ENTER>

```
RS?
```

The Titrino prompts for the calculation of the next result.

2 x <QUIT>

Quit the formula entry by pressing <QUIT> twice.

In order to be able to calculate the result, enter the calculation constants used in the formula.

Entry of the calculation constants

<C-FMLA>

```
C-fmla
>C01                    0.0
```

- Press <C-FMLA>.

The constants which have been used in the formula are requested: input with digit keys, confirm with <ENTER>.

C01: Concentration of your titrant= 0.1 mol/L.
Enter 0.1.

0.1
<ENTER>

```
C-fmla
>C02                    0.0
```

C02: Molar mass of HCl = 36.47 g/mol
Enter 36.47.

36.47
<ENTER>

Now only the constant C00 is missing to perform the calculation. This constant is reserved for the sample size. It can be entered directly.

Entry of the sample size

4 x <SMPL DATA>

```
smpl data
smpl size            1.0 g
```

- Press <SMPL DATA> repeatedly until "sample size" appears in the display.

<2>
<ENTER>

```
smpl data
smpl unit:             g
```

- Enter 2.

<SELECT>

<ENTER>

- Use <SELECT> to select the unit "mL" and confirm the new value with <ENTER>.

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

Display of the result

<SELECT>

```
SET pH           ********
>display results
```

- Press <SELECT> repeatedly until ">display results" appears in the display.

<ENTER>

```
SET pH           ********
RS1              3.71 g/l
```

- Press <ENTER> to move to the result display.

If you have a printer connected, you probably wish to have the curve and a result report printed out automatically at the end of a titration.
To install a printer, see page 119.

Print reports

3 x <DEF>

```
def
>report
```

- Press <DEF> repeatedly until the display shows:

<ENTER>

```
report:
```

- Press <ENTER> to move to the definition of reports.

3 x <SELECT>
<;>

```
report:curve;full
```

- With <SELECT> you select the individual repot blocks. Use a ";" as delimiter between the report blocks to print more than one block. If you wish to print out a full result report, enter "full".

<ENTER>
<QUIT>

- Confirm the entry with <ENTER> and quit the inquiries with <QUIT>.

Now print your reports by pressing <PRINT><REPORTS><ENTER>. Your printout will look like the following:

```
 'fr
719 S Titrino       18200        719.0021
date  2002-03-13     time 17:34          1
pH(init)         2.40   SET pH   ********
smpl size           2 ml
EP1              2.032 ml              8.14
RS1               3.71 g/l
         --------------
```

Identification of the report type (fr=full report)
Device type, device number and program version

Initial pH value, mode and method name

Volume and pH value of EP1
Calculated result

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

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

2.4.3 Storage and loading of methods

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

Storage of a method

2 × <USER METH>

```
user methods
>store method
```

- Press <USER METH> repeatedly until the title ">store method" appears in the display.

<ENTER>

- Open the inquiry with <ENTER>.

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

- Enter an identifier, e.g. 1 or Acid.
  For text input see page 8.

<ENTER>

```
SET pH                Acid
```

The method now runs under the name "Acid". It is ready to titrate.

If you have a printer connected, you can print out the contents of your method memory.
Key sequence: <PRINT><USER METH><ENTER>

Stored methods can be loaded at any time.

Loading a method from the method memory

<USER METH>

```
user methods
>recall method
```

- Press <USER METH>. The display shows the title ">recall method".

<ENTER>

- Open the inquiry <ENTER>

```
>recall method
method name:      ********
```

<SELECT>
or
direct entry

- You can select the desired method with <SELECT> (it shows all methods of the method memory one after the other) or by directly enter the method name.

<ENTER>

- Load the method with <ENTER>

```
SET pH                Acid
```

The method is ready to titrate.

2.4.4 pH calibration

For end-point titrations, however, where titration is performed to a fixed, specified pH value, a calibration should be performed.

Selection of the calibration mode, CAL

<MODE>

- Press <MODE> repeatedly until "CAL" appears in the display and confirm the mode with <ENTER>.

<ENTER>

The instrument is ready for a 2-point calibration. The second display line shows the current calibration data for measuring input 1.

Calibration procedure

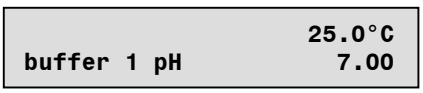
<START>

- Immerse your electrode in the first buffer and start the calibration procedure.

Inquiry of calibration temperature.

- Enter the current temperature. If you have a temperature sensor connected, this inquiry is skipped.

<ENTER>



pH value of the first buffer.

- Enter the pH value of the buffer at your calibration temperature.

<ENTER>

The voltage of the first buffer is measured. When the measured value has met the set drift criterion, the measurement is stopped and the pH value of the second buffer is requested.

- Now enter the pH value of the second buffer. If you require a 1-point calibration, you can also terminate the calibration with <STOP>.

<ENTER>
oder
<STOP>

At the end of the calibration, the calibration data obtained are displayed: asymmetry pH and slope.

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

The calibration report can be printed out at any time with the key sequence:
<PRINT><CAL.DATA><ENTER>

2.4.5 Statistics, acid capacity of drinking water

Let us now determine the acid capacity of drinking water. For this, the SET (**s**et **e**ndpoint **t**itration) mode is used to titrate to pH = 4.3.

Load the method "Acid", the one that you just have stored in the method memory, see page 16 .

Set the end point pH = 4.3 and dynamics 3 as you did with your first example (key <PARAM>). If you still feel unfamiliar with that, see page 11 again.

Now alter the calculation formula before the titration (keys <DEF>,<ENTER> and <1>). Delete the existing formula with <CLEAR> and enter the following formula:

RS1=EP1*C01*C02

with an accuracy of	RS1 decimal places	2
the unit	RS1 unit:	mmol/L

and the calculation constants	C01	1 (concentration of titrant ×10)
(key <C-FMLA>)	C02	4 (factor for the sample size 100 mL/25 mL)

If you have a printer connected to your Titrino, you can print out the titration parameters with the keys

<PRINT><PARAM><ENTER>.

Mount an Exchange Unit with *c*(HCl) = 0.1 mol/L as titrant. Add 25 mL drinking water as sample and start the titration with <START>. During the titration the first line of the display shows the measured value and dispensed volume. The "c" in pHc shows that the electrode assembly has been calibrated. The second line shows a "control bar", which indicates the control deviation of the current measured value from the set end point.

If the titration runs too slow or too fast, you can change the control parameters during the titration. If you wish to titrate faster, change the following parameters:

- dynamics: lower value, the control range becomes smaller (Attention: possibility of titrating over the set EP)
- max.rate: bigger value
- min.rate: bigger value

You will find further details of the control parameters on page 31.

After the titration, end point volume and pH value at the end point are displayed.

If the previous titration has run to your satisfaction, you can start thinking about performing statistics calculations. Have you already added a new sample to the titration vessel? If you are no longer certain, you can find out immediately with <MEAS/HOLD>.

Rapid measurement between titrations

Press <MEAS/HOLD>. The pH value of your sample is displayed. You can stop the measurement with a second <MEAS/HOLD>.

Statistics calculations

Now switch on the statistics calculations. Press <STATISTICS>. The "Statistics" LED is on. Duplicate determinations are now performed.

- Perform 2 titrations.

After the second titration you receive a printout with statistics calculations:

```
 'fr
719 S Titrino       18200        719.0021
date  2002-03-13     time 17:34          3
pHc(init)        6.29   SET pH       Acid
EP1            0.0628 ml              4.26
m value          5.02 mmol/l
              mean(2)   +/s           s/%
m value          5.04  0.028 mmol/l  0.56
           ==============
```

If you have no printer connected, you can view the mean value and standard deviation:

- Press <SELECT> until "display mean" appears in the display.
- With <ENTER> you obtain the mean value.
- A second <ENTER> displays the number of single values which have been used for the mean calculation.
- If you press <SELECT> again, the display "display std.deviation" appears. Once again, you can view this value, by pressing <ENTER>.

Perhaps you have noticed that the two values differ too greatly? In any case, we shall perform a third determination with the same sample. The result of this determination will be another value which is incorporated in the statistics calculations.

Addition of more determinations for the statistics calculations

5 × <PARAM>

```
parameters
>statistics
```

<ENTER>

- Press <PARAM> until the display shows:

```
>statistics
status:                  ON
```

<ENTER>

- Statistics calculations can be switched on either with the <STATISTICS> key or in the inquiry "status:". We shall leave them switched on and proceed to the next inquiry.

```
>statistics
mean:                n=  2
```

Mean value of 2 single determinations.

- Enter "3" to include an additional determination.

<3>
<ENTER>

2 × <QUIT>

- Quit the inquiry.

Perform another titration.

You can now decide which of the results is an "outlier". You can delete it from the statistics calculation.

Deleting a result from the statistics calculation

5 × <PARAM>

- Press <PARAM> until the display shows:

```
parameters
>statistics
```

3 × <ENTER>

- Select with <ENTER> the inquiry of the result table "res.tab:"

```
>statistics
res.tab:          original
```

2 × <SELECT>

- To delete a single result with index n from the result table, press <SELECT> so that "delete n" appears.

```
>statistics
res.tab:          delete n
```

<ENTER>

```
>statistics
delete            n=     1
```

- Enter index n of the result you wish to delete; in our example the second:

<2>
<ENTER>

2 × <QUIT>

- Quit the inquiry by pressing <QUIT>.

Mean value and standard deviation are recalculated and can be viewed in the display.

With <PRINT><REPORTS><ENTER> you can print a fresh report.

With <PRINT> <STATISTICS><ENTER> you can print a statistics overview, in this report the deleted result is marked with a "*" in the report.

2.5 Configuration, key <CONFIG>

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

```
configuration
>peripheral units
```

peripheral units:
Selection of printer, balance and the curve at the analog output.
auxiliaries:
e.g. setting of dialog language, date, time, etc.
RS232 settings:
RS parameters for the COM interface.
common variables:
Values of common variables.

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

```
>peripheral units
```

Settings for peripheral units

```
   send to:          IBM
```

Selection of printer (Epson, Seiko, Citizen, HP, IBM) at the Titrino Rs232 interface.
"Epson", for Epson
"Seiko", e.g. for DPU-414
"Citizen", e.g. for iDP 562 RS, Custom DP40-S4N
"HP" e.g. for Desk Jet types. Place curves always at the beginning of a page as you cannot have them over 2 pages.
"IBM" for all printers with IBM character set Table 437 and IBM graphics, as well as for the data transmission to a computer with Metrodata software TiNET or VESUV.

```
   balance:      Sartorius
```

Selection of balance (Sartorius, Mettler, Mettler AT, AND, Precisa)

Sartorius:	Models MP8, MC1
Mettler:	Models AM, PM, AX, MX, UMX and balances with 011, 012, or 016 interface
Mettler AT:	Model AT
AND:	Models ER-60, 120, 180, 182, FR-200, 300 and FX-200, 300, 320
Precisa:	Models with RS232C interface

```
   record:           U
```

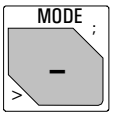
Selection of the curve for the output at the analog output (U, dU/dt, V, dV/dt, U(rel), T

U:.	Voltage
dU/dt:	Measured value drift
V:	Volume
dV/dt	Volume drift
U(rel):	Control deviation with SET
T:	Temperature with MEAS T

>auxiliaries	**General settings**
dialog: english	*Selection of dialog language (english, deutsch, francais, español, italiano, portugese, svenska)*
date 2001-03-13	*Current date (YYYY-MM-DD)* Format: Year-month-day, entry with leading zeros.
time 08:13	*Current time (HH-MM)* Format: Hours-minutes, entry with leading zeros.
run number 0	*Current run number for result output (0...9999)* The sample number is set to 0 when the instrument is switched on and incremented on every determination.
auto start OFF	*Automatic starts of titrations. (1...9999, OFF)* Number of automatic starts ("number of samples"). Used for instrument interconnections in which the external instrument does not initiate a start. Not advisable in connections with Sample Changers.
start delay 0 s	*Start delay (0...999999 s)* Delay time after start of methods. Abort start delay time with <QUIT>.
dev.label.	*Individual identification of devices (up to 8 ASCII characters)* Will be printed in the result report, see page 45.
program 719.0021	*Display of program version*
>RS232 settings	**Settings of RS232 interface** see also page 95ff.
baud rate: 9600	*Baud rate (300, 600, 1200, 2400, 4800, 9600)*
data bit: 8	*Data bit (7, 8)*
stop bit: 1	*Stop bit (1, 2)*
parity: none	*Parity (even, odd, none)*
handshake: HWs	*Handshake (HWs, HWf, SWline, SWchar, none)* see page 95ff.
RS control: ON	*Control via RS232 interface (ON, OFF)* "OFF" means that the receipt of commands via the RS232 interface is blocked. Data output is possible.

`>common variables`
 	
`C30 0.0`
`etc.`
	Values of the common variables
	
	Common variables C30...C39 (0.. ± 999 999)
	The values of all common variables are displayed. For creating of common variables see page 43.

2.6 Selection of the mode, key <MODE>



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

The following modes can be selected:
- SET: **S**et **E**ndpoint **T**itration.
- CAL: pH **Cal**ibration.
- MEAS: **Meas**uring.

These standard modes are loaded with a set of default parameters and are ready to work (only with SET an end point has to be set).

2.7 Parameters, key <PARAM>

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

2.7.1 Parameters for SET

parameters **>SET1**	**SET1, SET2:** Control parameters for EP1 and EP2. **titration parameters** are valid for the global titration sequence. **stop conditions:** Parameters for the termination of the titration. **statistics**: Calculation of mean values and standard deviation, see also page 41. **preselections**: ON/OFF of various auxiliary functions such as automatic requests after the start and activate pulse.
>SET1	**Control parameters for EP1 or EP2, resp.**
EP at pH **OFF** ***titr.**	*Preset EP1 (input range depends on the measured quantity:* *pH: 0...±20.00, OFF* *U, Ipol: 0...±2000 mV, OFF* *Upol: 0...±200.0 µA, OFF)* <CLEAR> sets "OFF". If EP1 is "OFF", no further inquiries under SET1 appear.
dynamics **OFF** ***titr.**	*Distance from EP where constant dosing should stop and controlling begins. (control range, input range depends on the measured quantity:* *pH: 0.01...20.00, OFF* *U, Ipol: 1...2000 mV, OFF* *Upol: 0.1...200.0 µA, OFF)* <CLEAR> sets "OFF". "OFF" means largest control range, i.e. low titration. Outside the control range, dispensing is performed continuously, see also page 31.

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

Maximum dosing rate (0.01...150 mL/min, max.)
<CLEAR> sets "max.".
This parameter determines primarily the addition rate outside the control range, see also page 31.
The maximum rate depends on the Exchange Unit:

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

min.rate 25.0 µl/min
***titr.*

Minimum dosing rate (0.01...999.9 µL/min)
This parameter determines the addition rate right at the start and the end of the titration, see also page 42.
This parameter influences the titration speed and therefore its accuracy very strongly: A smaller min.rate results in a slower titration.

stop crit: drift
***titr.*

Type of stop criteria (drift, time)

stop drift 20 µl/min
***titr.*

Titration stops if EP is and stop drift is reached. (1...999 µL/min)

t(delay) 10 s
***titr.*

Titration stops if there is no dosing during t(delay). (0...999 s, INF)
<CLEAR> sets "INF"
Switch off when the end point is reached and the set time after the last dispensing has elapsed.
If "INF" is set, an inquiry regarding the stop time appears.
If t(delay) is "INF"

stop time OFF s
***titr.*

Stop after a time (0...999999 s, OFF)
<CLEAR> sets "OFF".
Stop after the set time after the start of the titration. "OFF" means no stop, i.e. titration for an "infinitely" long time.

>titration parameters

General titration parameters

titr.direction: auto

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

pause 1 0 s
***titr.*

Pause 1 (0...999999 s)
Waiting time, e.g. for the equilibration of the electrode after the start. The waiting time can be aborted with <QUIT>.

start V: OFF
cond.

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

start V 0.0 ml
cond.

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

factor 0
cond.

If "rel." is set:
Factor for relative start volume (0...±999999).
Calculated as: start V (in mL) = factor∗sample size

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

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

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

pause 2 0 s
****titr.***

Pause 2 (0...999999 s)
Waiting time after start volume, e.g. reaction time after dosing of a start volume. The waiting time can be aborted with <QUIT>.

extr.time 0 s
****titr.***

Extraction time (0...999999 s)
During extraction time no dispensing occurs but the titration does not stop. The extraction time can be aborted with <QUIT>.

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 124.

With polarized electrodes, instead of the measuring input the

I(pol) 1 µA

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

U(pol) 400 mV

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

electrode test: OFF

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

temperature 25.0 °C
cond.

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

>stop conditions	**Stop conditions for titration** If this is not "normal", i.e. after reaching the EP.
stop V: abs. ****titr.***	*Type of stop volume (abs., rel., OFF)* "abs.": absolute stop volume in mL. "rel.": relative stop volume to sample size. "OFF": stop volume switched off. Stop volume is not monitored.
stop V 99.99 ml ****titr.***	If "abs." is set: *Absolute stop volume (0...9999.99 mL)*
factor 999999 ****titr.***	If "rel." is set: *Factor for relative stop volume (0...±999999)* Calculated as: Stop V (in mL) = factor∗sample size
filling rate max. ml/min	*Filling rate after the titration* *(0.01...150 mL/min, max.)* <CLEAR> sets "max.". The maximum rate depends on the Exchange Unit: Exchange Unit max. 5 mL 15 mL/min 10 mL 30 mL/min 20 mL 60 mL/min 50 mL 150 mL/min
>statistics	**Statistics calculation**
status: OFF	*Status of statistics calculation (OFF, ON)* If the statistics calculation is switched off, the following inquiries regarding the statistics do not appear.
mean n= 2	*Mean value calculation from n single results (2...20)*
res.tab: original	*Result table (original, delete n, delete all)* "original": The original table is used. Deleted individual results are again incorporated in the evaluation. "delete n": Deletion of single results with the index n. "delete all": The entire table is deleted.
delete n= 1	*Delete data from sample number n (1...20)* The deleted result is removed from 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)* Type of drift correction: (EP – drift ∗ time) auto: drift value at start is valid man.: see below OFF : no correction
drift value 0.0 µl/min ***cond.***	*Value for manual drift correction (0.0...99.9 µL/min)*
req.ident: OFF ***cond.***	*Request of identifications after start of titration (id1, id1&2, all, OFF)* After start, sample identifications can be requested automatically: Only id1, id1 & id2, all three id's or no inquiries.
req.smpl size: OFF ***cond.***	*Request of sample size after start of titration (value, unit, all, OFF)* "all" the value and the unit will be requested.
activate pulse: OFF ***cond.***	*Pulse output on I/O line 6 (L6, pin 1) of the remote socket (first, all, cond., OFF)* see page 131.

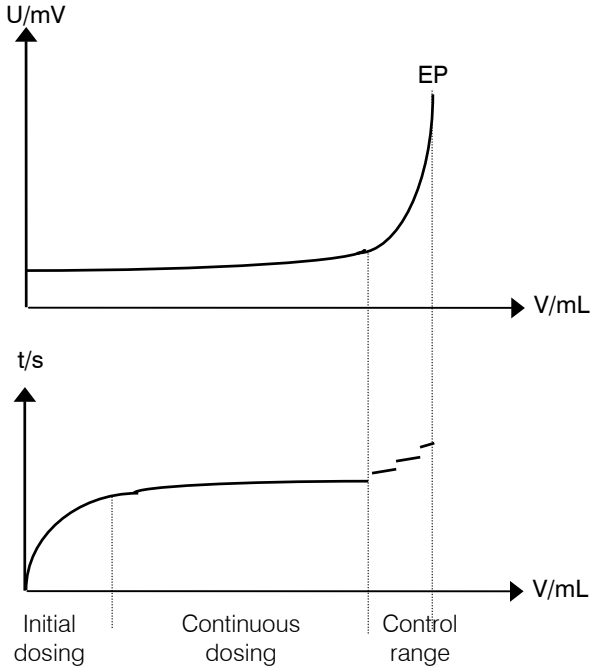
Titration sequence of SET

<START>	
(Activate pulse)	After the start, the activate pulse is outputted.
(Start delay)	The start delay time is waited off.
(Preconditioning) (<START>) (Activate pulse) (Start delay)	If conditioning is on, the sample solution is titrated until the (first) EP is reached. The display shows then **drift OK 2.3 µl/min** or **SET pH conditioning** The vessel is now conditioned. The titration can be started with <START>.
(Request ident.) (Request smpl size)	The sample identifications and the sample size are requested.
	The temperature is measured if a T sensor is connected.
(Start conditions)	Pause 1 is waited off, the start volume is dispensed, and pause 2 waited off.
(Extraction time) Titration with test of stop criterion	The titration to EP1, then to EP2 is executed. If the extraction time is not yet over when the EP's has been reached, the titration will only be terminated after the extraction time is over.
(Stirrer OFF)	Calculations are carried out.
Data output	Data are outputted.
(Reconditioning)	Conditioning is carried out.

Control parameters

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

During the titration, reagent dosing occurs in 3 phases:



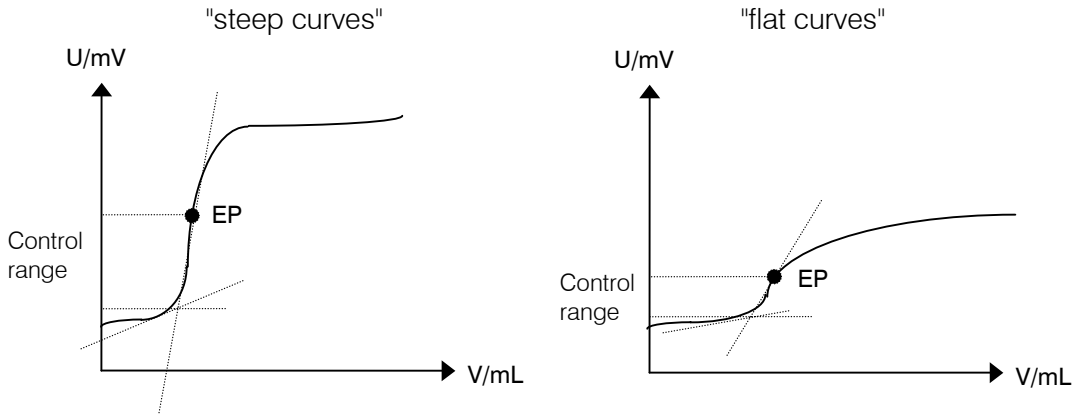
1. Initial dosing:
   Here the dosing rate increases constantly. The rate starts with "min.rate" and goes up to "max.rate".

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

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

Trial settings for the size of the control range

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



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

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

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

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

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

How to proceed if ...

Problem	Possible causes and corrective measures
Dosing at the end too long and with too small increments. "Never ends!"	• Increase "min.rate". Perform an experiment with a much higher min.rate. • Change switch-off criterion. Attempt, e.g. to increase the stop drift or use a shorter t(delay) as stop criterion. • Possibly pass an inert gas through the titration vessel.
"Overshoots". Titration is not controlled, i.e. at the end single pulses are not dosed.	• Lower "max.rate". • Set larger control range. • Set "min.rate" much lower. • Optimize arrangement of electrode and buret tip and improve stirring, see page 126. This is particularly important with very fast titration reactions and with steep curves.
Titration time is too long.	• Set higher "min.rate". • Set higher "max.rate". • Lower "dynamics".
Scatter in titration results is too great.	• Set "min.rate" lower.

2.7.2 Parameters for MEAS

parameters **>measuring parameters**	**measuring parameters** determine the measurement. **statistics**: Calculation of mean values and standard deviation, see also page 41. **preselections**: ON/OFF of various auxiliary functions such as automatic requests after the start and activate pulse.
>measuring parameters	**Measuring parameters**
signal drift OFF mV/min	*Drift criterion for measured value acquisition (input range depends on the measured quantity:* *pH, U, Ipol: 0.5...999 mV/min, OFF* *Upol: 0.05...99.9 µA/min, OFF* *T: 0.5...999 °C/min, OFF)* <CLEAR> sets "OFF". "OFF" means that the measured value is acquired after a fixed equilibration time.
equilibr.time OFF s	*Waiting time for measured value acquisition (0...9999 s, OFF)* <CLEAR> sets "OFF". If no new equilibration time has been entered, the Titrino calculates an equilibration time appropriate to the drift with the formula $\text{equilibr.time (in s)} = \frac{150}{\sqrt{\text{Drift} + 0.01}} + 5$ The measured value is acquired when the first criterion (drift or time) is met. With drift and time "OFF", you will have an "infinite" measurement.
meas.input: 1	*Measuring input for pH and U. (1, 2, diff.)* Inquiry only with measured quantities pH and U. Measuring input 1 or 2 or differential amplifier; connection of electrodes, see page 124.
I(pol) 1 µA **U(pol) 400 mV**	With polarized electrodes, instead of the measuring input the *polarization current (-127...127 µA)* or the *polarization potential (-1270...1270 mV, in steps of 10 mV)* is inquired.

electrode test: OFF	*Electrode test (OFF, ON)* Test for polarized electrodes. Performed on changeover from the inactive standby mode to a measurement. "OFF" means that the test is not performed.
temperature 25.0 °C	*Temperature (-170.0...500.0 °C)* Temperature is measured at the start if a T sensor is connected. This parameter is used for temperature compensation in pH measurements.
>statistics	**Statistics calculation**
status: OFF	*Status of statistics calculation (OFF, ON)* If the statistics calculation is switched off, the following inquiries regarding the statistics do not appear.
mean n= 2	*Mean value calculation from n single results (2...20)*
res.tab: original	*Result table (original, delete n, delete all)* "original": The original table is used. Deleted individual results are again incorporated in the evaluation. "delete n": Deletion of single results with the index n. "delete all": The entire table is deleted.
delete n= 1	*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 of titration (id1, id1&2, all, OFF)* After start, sample identifications can be inquired automatically: Only id1, id1 & id2, all three id's or no inquiries.
req.smpl size: OFF	*Request of sample size after start of titration (value, unit, all, OFF)*
activate pulse: OFF	*Pulse output on line "activate" (L6, pin 1) of the remote socket (ON, OFF)* see page 131.

2.7.3 Parameters for CAL

parameters **>calibration parameters**	**calibration parameters** determine the calibration procedure. **statistics**: Calculation of mean values and standard deviation, see also page 41.
>calibration parameters	**Calibration parameters**
meas.input: 1	*Measuring input (1, 2, diff.)* Measuring input 1 or 2 or differential amplifier; Connection of electrodes, see page 124.
cal.temp. 25.0 °C	*Calibration temperature (-20.0 ... 120.0 °C)* If a T sensor is connected, the temperature will be measured. The calibration temperature can also be input during the calibration sequence.
buffer #1 pH 7.00	*pH value of first buffer (0...±20.00)* The pH value of the buffers can be put in during the calibration sequence.
buffer #2 pH 4.00	*pH value of second and the following buffers (0...±20.00, OFF)* <CLEAR> sets "OFF".
buffer #3 pH OFF	Buffers are requested until "OFF" is set. This gives an n-point calibration. Up to 9 buffers. A regression line will be calculated in calibrations with more than 2 buffers.
signal drift 2 mV/min	*Drift for measured value acquisition (0.5...999 mV/min, OFF)* <CLEAR> sets "OFF". "OFF" means that the measured value is acquired after an equilibration time.
equilibr.time 110 s	*Equilibration time (0...9999 s, OFF)* <CLEAR> sets "OFF". If a new equilibration time has not been entered, the Titrino calculates an equilibration time appropriate to the drift, see page 32. The measured value is acquired as soon as the first criterion (drift or time) has been met. If drift and time are both set to "OFF", the measured value acquisition is immediate.
electr.id	*Electrode identification (up to 8 characters).*

sample changer cal: OFF	*Calibration with sample changer (ON, OFF)* In calibrations with a sample changer, there are no hold points in the calibration sequence for inputs. Calibration temperature and pH values of the buffers (which are temperature dependent) must therefore be entered in advance. The inputs in key <PARAM> are valid.
activate pulse: OFF	*Pulse output on the line "activate" (L6, pin 1) of the remote socket (all, first, OFF)* See page 131.
>statistics	**Statistics calculation**
status: OFF	*Status of statistics calculation (OFF, ON)* If the statistics calculation is switched off, the following inquiries regarding the statistics do not appear.
mean n= 2	*Mean value calculation from n single results (2...20)*
res.tab: original	*Result table (original, delete n, delete all)* "original": The original table is used. Deleted individual results are again incorporated in the evaluation. "delete n": Deletion of single results with the index n. "delete all": The entire table is deleted.
delete n= 1	*Delete data from sample number n (1...20)* The deleted result is removed from the statistics calculation.

Calibration sequence

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

2.8 Result calculations

Formula entry, key <DEF>

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

```
def
>formula
```

formula:
Formulas for result calculations.

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

```
>formula
```

Input of formulas

```
   RS?
```

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

```
   RS1=
```

Input of formula
Example:
RS1=EP1*C01/C00
Enter formula by means of 3rd functions of keyboard. Here you will find operands, mathematical operations and parentheses. Operands require a number as an identification. You can use the following operands:
EPX: EP's. X = 1...9
RSX: Results which have already been calculated with previous formulas. X = 1...9.
CXX: Calculation constants. XX = 00...79.

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

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

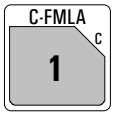
If a formula is stored with <ENTER>, result text, number of decimals and result unit will be requested:

RS1 text **RS1**	*Text for result output (up to 8 characters)* Text input see page 8.
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).* Enter next formula, e.g. for RS2.

Meaning of the calculation variables CXX:

C00	Sample size, see page 50.
C01...C19	Method specific operands, see below. They are stored with the method in the method memory.
C21...C23	Sample specific operands, see page 50ff.
C30...C39	Common variables.
C40	Initial measured value of the sample, last measured value in MEAS.
C41	End volume.
C42	Determination time.
C43	Volume drift for SET with conditioning.
C44	Temperature.
C45	Dispensed start volume.
C46	Asymmetry-pH (calibration).
C47	Electrode slope (calibration).

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>

2.9 Statistics calculation

Mean values, absolute and relative standard deviations are calculated.

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

```
def
>mean
```

mean:
Assigns values for statistics calculations.

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

```
>mean

   MN1=RS1
   MN2=
   :
   MN9=
```

Allocations for statistics calculations

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

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

```
>statistics

   status:              OFF

     mean               n=  2

     res.tab:       original

     delete             n=  1
```

Statistics calculation

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

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

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

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

How do you obtain statistics calculations?

1) Enter the allocations for the statistics calculation, see page 41.
2) Switch on the statistics calculations: Either with <STATISTICS> or set the status under <PARAM>, "> statistics" to "ON". The "Statistics" LED is on. Storing a method in the method memory, the status of the statistics calculation is retained.
3) Change the number of the individual values n under "mean n", if necessary.
4) Perform at least 2 titrations. The statistics calculation are constantly updated and printed. The values are printed in the short and full result report.
5) The statistics report can be printed with <PRINT><STATISTICS><ENTER>.

Rules:

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

2.10 Common variables

Common variables are used for:

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

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

 **def** **>common variables**	With <DEF>, results (RSX), endpoints (EPX), variables (CXX) or mean values (MNX) can be allocated as common variables. The entries are specific to the method and are stored in the method memory. **common variables**: Assigns values as common variables. The display texts of the Titrino are shown to the left. The values are the default values.
>common variables **C30=** **C31** **:** **C39=**	**Allocation for common variables** *Common variable C30...C39 (RSX, EPX, CXX, MNX)* Results (RSX), endpoints (EPX), variables (CXX), and means (MNX) can be assigned. The values of the common variables remain in force for all methods until they are overwritten or deleted. They can be viewed under the <CONFIG> key. Delete allocation with <CLEAR>+<ENTER>.

2.11 Data output

Reports for the output at the end of a determination

With <DEF>, the report sequence at the end of the determination is defined.
The entries are specific to the method and are stored in the method memory.

```
def
>report
```

report:
Definition of report blocks to be printed automatically at the end of the determination.

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

```
>report

   report:

   report:full
```

Report sequence: full, short, param, calc, calib, ff

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

Meaning of the report blocks:

full	Full result report with raw results, calculations and statistics.
short	Short result report with calculations and statistics.
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
719 S Titrino       18200        719.0021
date  2002-03-13     time 17:34          3
pHc(init)        6.29   SET pH       Acid
EP1             0.0628 ml             4.26
m value          5.02 mmol/l
              mean(2)   +/s           s/%
m value          5.04  0.028 mmol/l  0.56
device label   Titr 1        sign:
          ==============
```

Full result report

Device label (if there is a designation, see page 22) and manual signature

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> Cursor is pressed repeatedly until the desired report appears in the display.

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

List of reports:

Report	Display with <PRINT><SELECT>	<Key X>
Configuration report	configuration	CONFIG
Parameter report	parameters	PARAM
Current sample data	smpl data	SMPL DATA
Statistics report with the individual results	statistics	STATISTICS
All sample data from the silo memory	silo	SILO
Calibration data	cal.data	CAL.DATA
Operands C01...C19	C-fmla	C-FMLA
Contents of the <DEF> key	def	DEF
Contents of the method memory with details of the memory requirements of the individual methods and the remaining bytes	user methods	USER METH
Calculation report with formulas and operands	calc	
Full result report	full	
Short result report	short	
All reports	all	
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> key, the appropriate section (EP's, results, etc.) can be selected and <ENTER> can be used to view the individual EP's, results etc.

<SELECT>: display	<ENTER>: display	Remarks
`>display results`	`RS1...RS9`	calculated results
`>display EP's`	`EP1, EP2`	EP's
`>dispaly mean`	`m(RS1)...m(RS9),n`	mean values and number of individual values
`>display std.deviation`	`s(RS1)...d(RS2)`	absolute standard deviation
`>display messages`		various (error) messages
`>display meas.val`	`C4O`	with MEAS
`>display calibration`	`pH(as) and slope`	with CAL

2.12 Method memory, keys <USER METH>


```
user methods
>recall method
```

Management of the internal method memory with key <USER METH>.
Method identifications can be entered directly or selected with the <SELECT> key.

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

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

```
>recall method

   method name:
```

Recall method

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

```
>store method

   method name:
```

Store method

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

```
>delete method

   method name:
```

Delete method

Delete method from the internal method memory (input of method name, which is included in the memory).
For safety, you are again asked if you really wish to delete the method. With <ENTER> it is deleted, with <QUIT> you return to the working memory.
If a method name is entered which is not found in the method memory, the selected value blinks.

The contents of the method memory can be printed with the key sequence

<PRINT><USER METH><ENTER>

Document your methods (e.g. parameter report, def. report and C-fmla report)!
With a PC and the 6.6008.XXX Vesuv program, you should carry out a complete method backup from time to time.

2.13 Calibration data, key <CAL.DATA>

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

```
cal. data
>input 1
```

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

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

```
>input 1
```

pH calibration data for measuring input 1

```
  pH(as)          7.00
```

Asymmetry pH (0...±20.00)
Entered automatically after a calibration with measuring input 1.

```
   slope         1.000
```

Slope (0...±9.999)
Entered automatically after a calibration with measuring input 1.

```
   temp       25.0 °C
```

Calibration temperature (-20.0...120.0 °C)
Will be printed automatically after calibration with measuring input 1.

```
   cal.date
```

Date of last calibration (no entry possible)
If the calibration data "pH(as)" and/or "slope" are changed by a manual entry, the date entry is deleted.

```
   electr.id
```

Electrode identification of calibrated electrodes (no entry possible)
If an electrode identification has been entered in the CAL mode, it is automatically entered after the calibration.

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

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

2.14 Current sample data, key <SMPL DATA>


```
smpl data
>id#1 oer C21
```

The key <SMPL DATA> can be used to enter the current sample data. The contents of this key change when the silo memory is switched on, see page 52. Instead of entering the current sample data with <SMPL DATA>, you can request these data automatically after start of determinations. Configuration: <PARAM>, ">preselections". Current sample data can be entered live. For working with the silo memory see page 51.

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

smpl size:
Sample size.
Entry using keypad or via balance, see page 120.

smpl unit:
Unit of the sample size.

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

---

smpl data

Sample data

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

smpl size 1.0 g

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

smpl unit: g

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

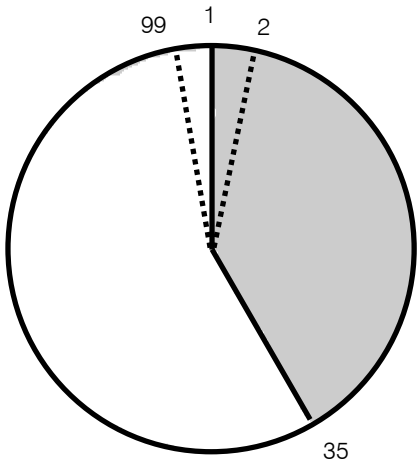
2.15 Silo memory for sample data

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.

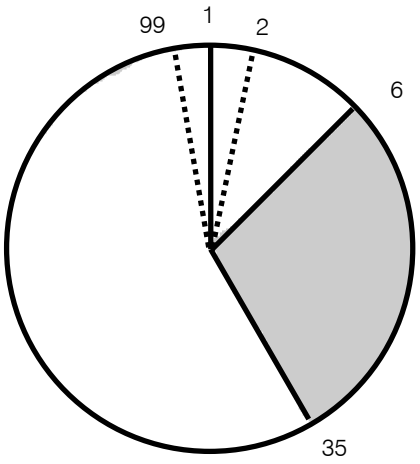
	Press the key <SILO> for working with the silo memory. The status LED "silo" is on when the silo memory is switched on. The silo memory works by the FIFO principle (First In, First Out).

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

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 90 bytes memory capacity.

Filling the silo memory with a connected balance

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

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

Key <SMPL DATA> with the silo memory switched on

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

```
smpl data
>edit silo lines
```

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

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

```
>edit silo lines

   silo line              1

   method:

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

   smpl size          1.0 g

   smpl unit:             g
```

Input for silo memory

Silo line (1...99)
The next free line is displayed automatically. Lines already occupied can be corrected.

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

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

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

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

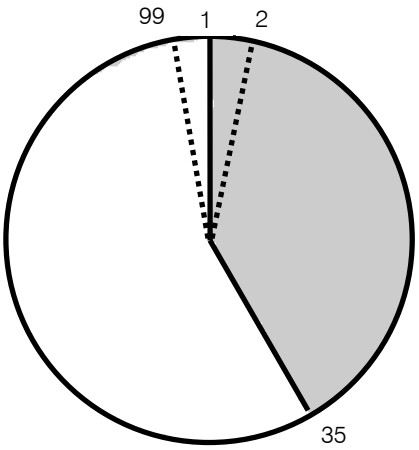
```
>delete silo lines

   delete line n        OFF
```

Delete individual silo lines

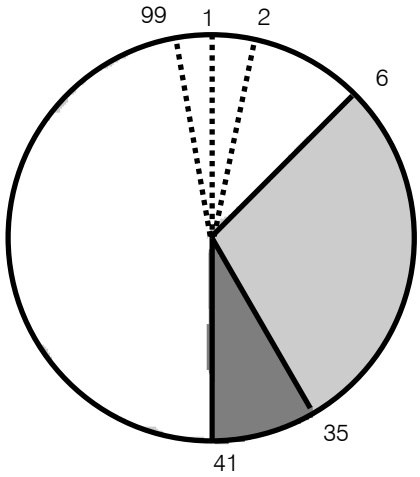
Line number of the line to be deleted(1...99, OFF)
<CLEAR> sets "OFF".
Deleted lines remain in the silo memory. Access is blocked during the processing. To show that a line has been deleted, they are marked with "∗". The symbol ∗ indicates that the line has been deleted.
Deleted lines can be reactivated if the appropriate line is re-edited.

>delete all silo lines **delete all: no**	**Delete all silo lines** *Confirmation (yes, no)* When all silo lines are deleted, the silo is completely empty: The line numbering starts again with 1.
cycle lines: OFF	*With "ON", worked off silo lines will be copied to the highest line of the silo memory (ON, OFF)* Data cycling "on" is useful if you constantly have to process the same sample data. In such a case, the processed silo line is not deleted, but copied to the next free line, see below. If you work in this mode, you should not enter any new silo lines during the determinations.

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.

3 Operation via RS232 Interface

3.1 General rules

The Titrino has an extensive remote control facility that allows full control of the Titrino via the RS 232 interface, i.e. the Titrino can receive data from an external controller or send data to an external controller. C_R and L_F are used as terminators for the data transfer. The Titrino sends 2xC_R and L_F as termination of a data block, to differentiate between a data line which has C_R and L_F as terminators. The controller terminates its commands with C_R and L_F. If more than one command per line is sent by the controller, ";" is used as a separator between the individual commands.

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

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

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

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

The quantities of the commands above are:

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

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

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

command.

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

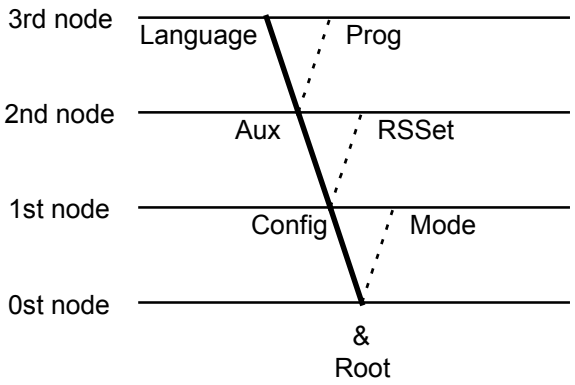
&**C**onfig.**A**ux.**L**anguage **$Q** Q means Query

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

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

3.1.1 Call up of objects

An excerpt from the object tree is represented below:



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

3.1.2 Triggers

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

The following triggers are possible:

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

The triggers $G and $S are linked to particular objects, see the summary table page 63ff.

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

Examples:

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

3.1.3 Status messages

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

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

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

Detailed status conditions

Status conditions of the global $G:

$G .Mode.SET	**.Inac**:	Instrument at the beginning or at the end of a titration.
	.Req .Id1:	Instrument in the SET mode, requesting Id1 after start.
	.Id2:	Instrument in the SET mode, requesting Id2 after start.
	.Id3:	Instrument in the SET mode, requesting Id3 after start.
	.Smpl:	Instrument in the SET mode, requesting sample size after start.
	.Unit:	Instrument in the SET mode, requesting unit of sample size after start.
	.Start:	Instrument in the SET mode, processing the start conditions.
	.SET1:	Instrument in the SET mode, titrating to the first endpoint.
	.SET2:	Instrument in the SET mode, titrating to the second endpoint.
	.Cond.Ok:	Instrument in the SET, conditioning, endpoint reached (after the first startup from the standby mode).
	.Cond.Prog:	Instrument in the SET mode, conditioning, endpoint not reached (Conditioning progressing).
$G .Mode.MEAS	**.Inac**:	Instrument at the beginning or at the end of a titration.
	.Req .Id1:	Instrument in the MEAS mode, requesting Id1 after start.
	.Id2:	Instrument in the MEAS mode, requesting Id2 after start.
	.Id3:	Instrument in the MEAS mode, requesting Id3 after start.
	.Smpl:	Instrument in the MEAS mode, requesting sample size after start.
	.Unit:	Instrument in the MEAS mode, requesting unit of sample size after start.
	.Meas:	Instrument in the MEAS mode, measuring.
$G .Mode.CAL	**.Inac**:	Instrument at the beginning or at the end of a calibration
	.Req.Temp:	Instrument in the CAL mode, requesting calibration temperature.
	.Meas.Temp:	Instrument in the CAL mode, measuring calibration temperature.
	.Req.Buf1:	Instrument in the CAL mode, requesting pH of buffer 1.
	.Meas.Buf1:	Instrument in the CAL mode, measures buffer 1.
	.Req.Buf2:	Instrument in the CAL mode, requesting pH of buffer 2.
	.Meas.Buf2:	Instrument in the CAL mode, measures buffer 2.
	etc.	
$G .Assembly.Bur	**.Fill**:	Buret in filling process
	.ModeDis:	Buret in DIS mode

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.XXX.

Status conditions of the global $C:

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

Status conditions of the global $R:

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

$R .Mode.SET .Inac: Instrument in the SET mode, inactive.
.Cond.Ok: Instrument in the SET mode, conditioning, endpoint reached.
.Cond.Prog: Instrument in the SET mode, conditioning, endpoint not reached.
$R .Mode.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.

Status conditions of the global $S:

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

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

3.1.4 Error messages

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

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.

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

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

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

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

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

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

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

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

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

RS receive errors:

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

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

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

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

RS send errors:

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

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

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

E43 The transmission of the Titrino has been interrupted with XOFF for at least 6 s.
Exit: Send XON or <QUIT>

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

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

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

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

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

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

E130 Wrong sample. For SET 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.
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, does not exist.
Exit: The error message disappears on next startup.

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

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

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

3.2 Remote control commands

3.2.1 Overview

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

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

&Mode

Object	Description	Input range	Reference
& Root			
├ **M**ode	**Mode**	$G, $S, $H, $C	3.2.2.1.
: ├ **.Q**uickMeas	Rapid meas. in basic mode	$G, $S	3.2.2.2.
├ **.S**elect	Mode selection	**SET**, MEAS,CAL	3.2.2.3.
├ .**SET**Quantity	Measured quantity for SET	**pH**, U, Ipol, Upol	ditto
├ .**MEA**SQuantity	Measured quantity for MEAS	**pH**, U, Ipol, Upol, T	ditto
├ **.N**ame	Name of current method	read only/read+write	3.2.2.4.
├ **.P**arameter*	Parameter of current mode, page 65ff		
├ **.Def**	**Definitions for data output**		
├ **.F**ormulas	**Calculation formulas**		
├ **.1**	for result 1		
├ **.F**ormula	Calculation formula	special	3.2.2.5.
├ **.T**extRS	Text for result output	up to 8 ASCII char	ditto
├ **.D**ecimal	Number of decimal places	0...**2**...5	ditto
├ **.U**nit	Unit for result output	up to 6 ASCII char	ditto
:	up to 9 results		
├ **.C**omVar	**Assignment of common variables**		
├ **.C**30	for C30	RSX,EPX,CXX,MNX	3.2.2.6.
├ up to C39			
├ **.R**eport	**Reports at the end of determination**		
├ **.A**ssign	Assignment	depends on mode	3.2.2.7.
├ **.M**ean	**Assignment for mean calculation**		
├ **.1**	MN1		
├ **.A**ssign	Input of variable	RSX, EPX, CXX	3.2.2.8.
up to 9			
├ **.C**Fmla	**Calculation constants**		
├ **.1**	Calculation constant C01		
├ **.V**alue	Input of value	**0**...±999 999	3.2.2.9.
├ up to C19			

***Parameter**	**Tree part "Parameters for SET"**		
├ .**S**ET1	**Control parameters for EP1**		
│ ├ .**E**P	Endpoint 1	depends on meas.quant.	3.2.2.10.
│ ├ .**U**nitEp	Unit of endpoint	read only	ditto
│ ├ .**D**yn	Dynamics	depends on meas.quant.	3.2.2.11.
│ ├ .**UnitD**yn	Unit of dynamics	read only	ditto
│ ├ .**M**axRate	Maximum dosing rate	0.01...**10**...150, max.	ditto
│ ├ .**Mi**nRate	Minimum dosing rate	0.01...**25.0**...9999	ditto
│ ├ .**S**top	Titration stop		
│ │ ├ .**T**ype	Type of stop criterion	**drift**, time	3.2.2.12.
│ │ ├ .**D**rift	Stop drift	1...**20**...999	ditto
│ │ ├ .**Ti**me	Switch-off delay time	0...**10**...999, inf	ditto
│ │ ├ .**S**topT	Stop time	0...999 999, **OFF**	ditto
├ .**SET2**	**Control parameters for EP2, as for EP1**		
├ .**T**itrPara	**Titration parameters**		
│ ├ .**D**irection	Titration direction	+, -, **auto**	3.2.2.13.
│ ├ .**X**Pause	Pause 1	**0**…999 999	3.2.2.14.
│ ├ .**S**tart V	Start volume		
│ │ ├ .**T**ype	Type of start volume	abs., rel., **OFF**	3.2.2.15.
│ │ ├ .**V**	Volume for absolute start volume	**0**...999.99	ditto
│ │ ├ .**F**actor	Factor for relative start volume	**0**...±999 999	ditto
│ │ ├ .**R**ate	Dispensing rate for start volume	0.01...150.0, **max.**	ditto
│ ├ .**P**ause	Pause 2	**0**...999 999	3.2.2.16.
│ ├ .**E**xtrT	Extraction time	**0**...999 999	3.2.2.17.
│ ├ .**M**easInput	Measuring Input	**1**, 2, diff.	3.2.2.18.
│ ├ .**I**pol	Polarization current	0...**1**...±127	ditto
│ ├ .**U**pol	Polarization voltage	0...**400**...±1270	ditto
│ ├ .**Po**lElectrTest	Test for polarized electrodes	ON, **OFF**	ditto
│ ├ .**T**emp	Titration temperature	-170.0...**25.0**...500.0	3.2.2.19.
├ .**St**opCond	**Stop conditions**		
│ ├ .**V**Stop	Stop volume		
│ │ ├ .**T**ype	Type of stop volume	**abs**., rel., OFF	3.2.2.20.
│ │ ├ .**V**	Volume for absolute stop volume	0...**99.99**...9999.99	ditto
│ │ ├ .**F**actor	Factor for relative stop volume	0...±**999 999**	ditto
│ ├ .**F**illRate	Filling rate	0.01...150.0, **max.**	3.2.2.21.
├ .**Sta**tistics	**Statistics**		
│ ├ .**S**tatus	Status of statistics calculation	ON, **OFF**	3.2.2.22.
│ ├ .**M**eanN	No. of individual determinations	**2**...20	ditto
│ ├ .**R**esTab	Result table		
│ │ ├ .**S**elect		**original**,delete n,delete all	ditto
│ │ ├ .**D**elN	Deletion of individual results	**1**...20	ditto
├ .**P**resel	**Preselections**		
│ ├ .**C**ond	Conditioning	ON, **OFF**	3.2.2.23.
│ ├ .**D**riftDisp	Display of drift during cond.	**ON**, OFF	ditto
│ ├ .**DC**or	Drift Correction		
│ │ ├ .**T**ype	Drift type	auto, man., **OFF**	3.2.2.24.
│ │ ├ .**V**alue	Value for manual drift correction	**0.0**…99.9	ditto
│ ├ .**I**Req	Request of Id's after start	id1, id1&2, all, **OFF**	3.2.2.25.
│ ├ .**S**Req	Request of smpl size after start	value, unit, all, **OFF**	ditto
│ ├ .**A**ctPulse	Output of a pulse	first, all, cond., **OFF**	3.2.2.26.

*Parameter	Tree part "Parameters for MEAS"		
.Measuring	**Measuring parameters**		
.SignalDrift	Drift for meas.value acquisition	depends on meas.quant.	3.2.2.27.
.UnitSigDrift	Unit of measured value drift	read only	ditto
.EquTime	Equilibrium time	0...9999, **OFF**	ditto
.MeasInput	Measuring input	**1**, 2, diff.	3.2.2.28.
.Ipol	Polarization current	0...**1**...±127	ditto
.Upol	Polarization voltage	0...**400**...±1270	ditto
.PolElectrTest	Test for polarized electrodes	ON, **OFF**	ditto
.Temp	Titration temperature	-170.0...**25.0**...500.0	3.2.2.29.
.Statistics	**Statistics**		
.Status	Status of statistics calculation	ON, **OFF**	3.2.2.22.
.MeanN	No. of individual determinations	**2**...20	ditto
.ResTab	Result table		
.Select		**original**,delete n,delete all	ditto
.DelN	Deletion of individual results	**1**...20	ditto
.Presel	**Preselections**		
.IReq	Request of Id's after start	id1, id1&2, all, **OFF**	3.2.2.24.
.SReq	Request of sample size after start	value, unit, all, **OFF**	ditto
.ActPulse	Output of a pulse	ON, **OFF**	3.2.2.25.

*Parameter	Tree part "Parameters for CAL"		
.Calibration	**Calibration parameters**		
.MeasInput	Measuring input	**1**, 2, diff.	3.2.2.30.
.CalTemp	Calibration temperature	-20.0...**25.0**...120.0	3.2.2.31.
.Buffer			
.1			
.Value	pH value of buffer 1	0...**7.00**...±20.00	3.2.2.32.
.2			
.Value	pH value of buffer 2	0...**4.00**...±20.00, OFF	ditto
:	up to 9 buffers		
.SignalDrift	Drift for meas.value acquisition	0.5…**4.00**…999, OFF	3.2.2.33.
.EquTime	Equilibrium time	0...**110**...9999, OFF	ditto
.ElectrodeId	Electrode identification	8 ASCII char.	3.2.2.34.
.SmplChanger	Calibration on a Titrino	ON, **OFF**	3.2.2.35.
.ActPulse	Output of a pulse	first, all, **OFF**	3.2.2.36.
.Statistics	**Statistics**		
.Status	Status of statistics calculation	ON, **OFF**	3.2.2.22.
.MeanN	No.of individual determinations	**2**...20	ditto
.ResTab	Result table		
.Select		**original**,delete n,delete all	ditto
.DelN	Deletion of individual results	**1**...20	ditto

&UserMeth

Object	Description	Input range	Reference
& Root			
⋮			
⋮ ├ **U**serMeth	**Method memory**		
⋮ │ ├ **.F**reeMemory	Memory available	read only	3.2.2.37.
⋮ │ ├ **.R**ecall	Load method	$G	3.2.2.38.
⋮ │ │ ├ **.N**ame	Method name	8 ASCII characters	ditto
⋮ │ ├ **.S**tore	Save method	$G	ditto
⋮ │ │ ├ **.N**ame	Method name	8 ASCII characters	ditto
⋮ │ ├ **.D**elete	Delete method	$G	ditto
⋮ │ │ ├ **.N**ame	Method name	8 ASCII characters	ditto
⋮ │ ├ **.DelA**ll	Delete all methods	$G	ditto
⋮ │ ├ **.L**ist	List of methods		
⋮ │ │ ├ **.1**	Method 1		
⋮ │ │ │ ├ **.N**ame	Method name	read only	3.2.2.39.
⋮ │ │ │ ├ **.M**ode	Mode	read only	ditto
⋮ │ │ │ ├ **.Q**uantity	Measured quantity	read only	ditto
⋮ │ │ │ ├ **.B**ytes	Method size in bytes	read only	ditto
⋮ │ │ │ ├ **.C**hecksum	Checksum of method	read only	ditto
⋮ │ │ ├ **.2**	for each method		

&Config

Object	Description	Input range	Reference
& Root			
├ **C**onfig	**Instrument configuration**		
├ **.P**eriphUnit	**Selection of peripheral units**		
├ **.C**harSet	External printer	Epson,Seiko,Citizen **IBM**,HP	3.2.2.40.
├ **.B**alance	Selection of balance	**Sartorius**,Mettler,Mettler AT AND,Precisa	3.2.2.41.
├ **.P**lot	Selection of plot at analog output	**U**, dU/dt, V, dV/dt U(rel), T	ditto
├ **.A**ux	**Miscellaneous**		
├ **.L**anguage	Dialog language	**english**, deutsch, francais, espanol, italiano, portugese, svenska	3.2.2.42.
├ **.S**et	Setting of date and time	$G	3.2.2.43.
├ **.D**ate	Date	XXXX-XX-XX	
├ **.T**ime	Time	XX:XX	
├ **.R**unNo	Run number	**0**...9999	3.2.2.44.
├ **.A**utoStart	Automatic start	1...9999, **OFF**	3.2.2.45.
├ **.St**artDelay	Start delay time	**0**...999 999	3.2.2.46.
├ **.D**evName	Device label	8 ASCII char.	3.2.2.47.
├ **.P**rog	Program version	read only	3.2.2.48.
├ **.R**SSet	**Settings RS232**	$G	3.2.2.49.
├ **.B**aud	Baud rate	300,600,1200,2400,4800, **9600**	
├ **.D**ataBit	Number of data bits	7, **8**	ditto
├ **.S**topBit	Number of stop bits	**1**, 2	ditto
├ **.P**arity	Parity	even, odd, **none**	ditto
├ **.H**andsh	Handshake	**HWs**, HWf, SWchar, SWline, none	ditto
├ **.C**omVar	**Values of common variables**		
├ **.C**30	C30	**0**... ±999 999	3.2.2.50.
├ up to C39	**0**... ±999 999		

&SmplData

Object	Description	Input range	Reference
& Root			
├ **S**mplData	**Sample data**		
├ **.S**tatus	Status of silo memory	ON, **OFF**	3.2.2.51.
├ **.O**FFSilo	Current sample data		
├ **.I**d1	Sample identification 1	up to 8 ASCII char	3.2.2.52.
├ **.Id2**	Sample identification 2	up to 8 ASCII char	ditto
├ **.Id3**	Sample identification 3	up to 8 ASCII char	ditto
├ **.V**alSmpl	Sample size	±X.XXXXX	ditto
├ **.U**nitSmpl	Unit of sample size	up to 5 ASCII char	ditto
├ **.ON**Silo	Current sample data		
├ **.C**ounter	Counter of silo memory		
├ **.M**axLines	Maximum lines	read only	3.2.2.53.
├ **.F**irstLine	First line	read only	ditto
├ **.L**astLine	Last line	read only	ditto
├ **.E**ditLine	Editing silo lines		
├ **.1**	1st silo line		
├ **.M**ethod	Method name	up to 8 ASCII char	3.2.2.54.
├ **.I**d1	Sample identification 1	up to 8 ASCII char	ditto
├ **.Id2**	Sample identification 2	up to 8 ASCII char	ditto
├ **.Id3**	Sample identification 3	up to 8 ASCII char	ditto
├ **.V**alSmpl	Sample size	±X.XXXXX	ditto
├ **.U**nitSmpl	Unit of sample size	up to 5 ASCII char	ditto
├ up to 99 lines			
├ **.D**elLine	Delete silo line	$G	3.2.2.55.
├ **.L**ineNum	Line number	1...99, **OFF**	ditto
├ **.DelA**ll	Delete silo line	$G	3.2.2.56.
├ **.Cy**cleLines	Cycle lines	ON, **OFF**	3.2.2.57.

&Info

Object	Description	Input range	Reference
& Root			
├ **I**nfo	**Current data**		
├ **.R**eport	**Transmission of formatted reports**	$G	3.2.2.58.
├ **.S**elect	Report type	configuration, parameters, smpl data, statistics, silo, calib C-fmla, def, user method, **full**, short, calc, all, ff	ditto
├ **.C**alibrationData	**pH calibration data**	$G	3.2.2.59.
├ **.I**np1	For measuring input 1		
├ **.p**Has	Asymmetry pH	0...**7.00**...±20.00	ditto
├ **.S**lope	Slope of electrode	0...**1.000**...±9.999	ditto
├ **.T**emp	Calibration temperature	-170.0...**25.0**...500.0	ditto
├ **.D**ate	Date of calibration	read only	ditto
├ **.E**lectrodeId	Id of the calibrated electrode	read only	ditto
├ **.Inp2**	For measuring input 2, as for input 1		
├ **.D**iff	For differential input, as for input 1		
├ **.C**hecksums	**Checksums**	$G	3.2.2.60.
├ **.A**ctualMethod	Checksum of current method	read only	ditto
├ **.D**etermData	**Determination data**	$G	3.2.2.61.
├ **.W**rite	Read/write for several nods	ON, **OFF**	
├ **.E**xV	Volume of Exchange/Dosing unit	read only/read+write	ditto
├ **.T**itrResults	**Titration results**		
├ **.R**S	Calculated results		
├ **.1**	1st result		
├ **.V**alue	Value	read only	3.2.2.62.
├ up to 9 results			
├ **.E**P	Endpoint		
├ **.1**	1st result		
├ **.V**	Value	read only	ditto
├ **.M**eas	Measured value	read only	ditto
├ up to 2 EP's			
├ **.V**ar	Variables C4X		
├ **.C**40	Start measured value	read only/read+write	ditto
├ **.C41**	Titration end volume	read only/read+write	
├ **.C42**	Titration time	read only/read+write	
├ **.C43**	Volume drift in SET	read only/read+write	
├ **.C44**	Titration temperature	read only/read+write	
├ **.C45**	Start volume	read only/read+write	
├ **.C46**	Asymmetry pH	read only	
├ **.C47**	Slope of electrode	read only	
├ **.D**Time	Time for drift correction	read only/read+write	
├ **.S**tatisticsVal	**Statistics values**		
├ **.A**ctN	Number of results in chart	read only	3.2.2.63.
├ **.1**	1st mean		
├ **.M**ean	Mean	read only	ditto
├ **.S**td	Absolute standard deviation	read only	ditto
├ **.R**elStd	Relative standard deviation	read only	ditto

├ up to 9 mean values			
├ **.A**ctualInfo	**Current data**		
├ **.I**nputs	I/O Inputs		
├ **.S**tatus	Line status	read only	3.2.2.64.
├ **.C**hange	Change of line status	read only	ditto
├ **.Cl**ear	Clear change	$G	ditto
├ **.O**utputs	as for I/O Inputs		ditto
├ **.S**tatus	Line status	read only	ditto
├ **.C**hange	Change of line status	read only	ditto
├ **.Cl**ear	Clear change	$G	ditto
├ **.A**ssembly	From Assembly		
├ **.C**yclNo	Cycle number	read only	3.2.2.65.
├ **.Co**unter	Assembly counter	read only	3.2.2.66.
├ **.V**	Volume counter	read only	ditto
├ **.C**lear	Clears counter	$G	ditto
├ **.P**istonPos	Measured value	read only	3.2.2.67.
├ **.M**eas	Measured value	read only	ditto
├ **.T**itrator	From Titrator		
├ **.C**yclNo	Cycle number	read only	3.2.2.68.
├ **.V**	Volume	read only	ditto
├ **.M**eas	Measured indicator voltage	read only	ditto
├ **.d**Vdt	Volume drift dV/dt	read only	ditto
├ **.dM**easdt	Measured value drift	read only	ditto
├ **.dMeasdV**	1st deviation of titration curve	read only	ditto
├ **.E**P	EP entry		
├ **.I**ndex	Index of entry	read only	3.2.2. 69.
├ **.X**	X coordinate	read only	ditto
├ **.Y**	Y coordinate	read only	ditto
├ **.D**isplay	**Display**		
├ **.L**1	Text line 1	up to 24 ASCII char	3.2.2.70.
├ **.L2**	Text line 2	up to 24 ASCII char	ditto
├ **.As**sembly	**Assembly**		
├ **C**ycleTime	Cycle time	read only	3.2.2.71.
├ **E**xV	Volume of Exchange unit	read only	ditto

&Assembly

Object	Description	Input range	Reference
& Root			
├ **A**ssembly	**Assembly control**		
├ **. B**ur	**Buret**		
├ **.R**ates	Rates		
├ **.F**orward	Forward rate		
├ **.S**elect	Type of rate control	digital, **analog**	3.2.2.72.
├ **.D**igital	Digital rate	0...150, **max**.	ditto
├ **.R**everse	as for forward rate		
├ **.S**elect	Type of rate control	digital, **analog**	ditto
├ **.D**igital	Digital rate	0...150, **max**.	ditto
├ **.F**ill	Fill	$G,$H,$C	3.2.2.73.
├ **.M**odeDis	Dispensing	$G,$S,$H,$C	3.2.2.74.
├ **.S**elect	Type of dispensing control	**volume**, time	ditto
├ **.V**	Volume to be dispensed	0.0001...**0.1**...9999	ditto
├ **.T**ime	Time to dispense	0.25...**1**...86 400	ditto
├ **.VS**top	Limit volume	0.0001...9999, **OFF**	ditto
├ **.A**utoFill	Filling after each increment	ON, **OFF**	ditto
├ **.M**eas	**Measuring**		
├ **.S**tatus	Measuring ON/OFF	ON, **OFF**	3.2.2.75.
├ **.M**easInput	Selection of measuring input	**1**, 2, diff., Ipol, Upol, Temp	ditto
├ **.I**pol	Polarization current	0...**1**...±127	ditto
├ **.U**pol	Polarization voltage	0...**400**...±1270	ditto
├ **.O**utputs	**I/O outputs**		
├ **.A**utoEOD	Automatic output of EOD	**ON**, OFF	3.2.2.76.
├ **.S**etLines	Set I/O lines	$G	ditto
├ **.L**0	Signal on L0	active,inactive,pulse,**OFF**	ditto
├ up to L 3			
├ **.R**esetLines	Reset I/O lines	$G	ditto

&Setup

Object	Description	Input range	Reference
& Root			
⋮			
├ **Se**tup	**Settings for the operating mode**		
├ **.K**eycode	Send key code	ON, **OFF**	3.2.2.77.
├ **.T**ree	Sending format of path info		
├ **.S**hort	Short format of path	ON, **OFF**	3.2.2.78.
├ **.C**hangedOnly	Paths of modified nodes only	ON, **OFF**	ditto
├ **.Tra**ce	Message on changed values	ON, **OFF**	3.2.2.79.
├ **.L**ock	**Lock key functions**		
├ **.K**eyboard	Lock all keyboard keys	ON, **OFF**	3.2.2.80.
├ **.C**onfig	Lock <CONFIG> key	ON, **OFF**	ditto
├ **.P**arameter	Lock <PARAM> key	ON, **OFF**	ditto
├ **.S**mplData	Lock <SMPL DATA> key	ON, **OFF**	ditto
├ **.U**serMeth	Lock functions		
├ **.R**ecall	Lock “loading”	ON, **OFF**	ditto
├ **.S**tore	Lock “saving”	ON, **OFF**	ditto
├ **.D**elete	Lock “deletion”	ON, **OFF**	ditto
└ **.D**isplay	Lock display function	ON, **OFF**	ditto
├ **.M**ode	**Setting waiting intervals**		
├ **.S**tartWait	Waiting time after start	ON, **OFF**	3.2.2.81.
├ **.F**inWait	Waiting time after run	ON, **OFF**	ditto
├ **.S**endMeas	**Automatic sending of measured values**		
├ **.S**endStatus	Connect/disconnect sending	ON, **OFF**	3.2.2.82.
├ **.I**nterval	Time interval	0.08...**4**...16200,	ditto
├ **.Sel**ect	Selection	Assembly, **Titrator**	3.2.2.83.
├ **.A**ssembly	From assembly		
├ **.C**yclNo	Cycle number	ON, **OFF**	3.2.2.84.
├ **.V**	Volume	ON, **OFF**	ditto
├ **.M**eas	Measured indicator voltage	ON, **OFF**	ditto
├ **.T**itrator	From Titrator		
├ **.C**yclNo	Cycle number	ON, **OFF**	3.2.2.85.
├ **.V**	Volume	ON, **OFF**	ditto
├ **.M**eas	Measured indicator voltage	ON, **OFF**	ditto
├ **.d**Vdt	Volume drift dV/dt	ON, **OFF**	ditto
├ **.dM**easdt	Measured value drift	ON, **OFF**	ditto
├ **.dMeasdV**	1st deviation of titration curve	ON, **OFF**	ditto
├ **.A**utoInfo	**Automatic message for changes**		3.2.2.86.
├ **.S**tatus	Switch AutoInfo on/off	**ON**, OFF	ditto
├ **.P**	When mains is switched on	ON, **OFF**	ditto
├ **.T**	**Titrator infos**		
├ **.R**	When “ready”	ON, **OFF**	ditto
├ **.G**	When method started	ON, **OFF**	ditto
├ **.GC**	When start is initiated	ON, **OFF**	ditto
├ **.S**	When stopped	ON, **OFF**	ditto
├ **.B**	Begin of method	ON, **OFF**	ditto
├ **.F**	End of process	ON, **OFF**	ditto
├ **.E**	Error	ON, **OFF**	ditto
├ **.H**	When “hold"	ON, **OFF**	ditto

.C	Continue after "hold"	ON, **OFF**	ditto
.O	Conditioning OK	ON, **OFF**	ditto
.N	Conditioning not OK	ON, **OFF**	ditto
.Re	Request after start	ON, **OFF**	ditto
.Si	Silo empty	ON, **OFF**	ditto
.EP	Entry in EP list	ON, **OFF**	ditto
.RC	Recalculation of results done	ON, **OFF**	ditto
.I	Changing an I/O input	ON, **OFF**	ditto
.O	Changing an I/O output	ON, **OFF**	ditto
.PowerOn	RESET (power on)	$G	3.2.2.87.
.Initialise	Set default values	$G	3.2.2.88.
.Select	Selection of branch	**ActMeth**,Config,Silo,Calib Assembly,Setup,All	ditto
.RamInit	Initialization of working mem.	$G	3.2.2.89.
.InstrNo	Device Identification	$G	3.2.2.90.
.Value	Input of device identification	8 ASCII characters	ditto

&Diagnose

Object	Description	Input range	Reference
& Root			
┆			
├ **D**iagnose	**Diagnose**		
├ **.R**eport	Output of adjustment parameters	$G	3.2.2.91.

3.2.2 Description of the remote control commands

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

Start and stop ($G, $S) or hold of the current method (3.2.2.3) with $H and continue with $C.
$G also serves to continue after inquiries of identifications and sample size after the start (see 3.2.2.25) as well as after inquiries of calibration temperature and pH values of buffers (see 3.2.2.31 and 3.2.2.32).

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

Start and stop of a measurement in the basic mode with the parameters (measured quantity, measuring input) of the current method. Corresponds to the <meas/hold> key.
With an ongoing measurement, the current mode can be started. This stops the measurement automatically.

3.2.2.3. **M**ode.**S**elect **SET**, MEAS, CAL
Mode.**SET**Quantity **pH**, U, Ipol, Upol
Mode.**MEA**SQuantity **pH**, U, Ipol, Upol, T

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

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

Name of the current method in the working memory. $Q sends 8 ASCII characters. Standard methods carry the name ********. The node can be set read + write, see 3.2.2.61.

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

Entry of formulas. Rules for formula entry, see page 39f.
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. It is used for the result and the corresponding mean value.

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

Assignment of common variables.
The values of the common variables are to be found in &Config.ComVar. They can be viewed and entered there, see 3.2.2.50.

3.2.2.7. **M**ode.**Def.R**eport.**A**ssign
SET, MEAS, CAL: full, short, calc, param, calib, 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 ";".

3.2.2.8. **M**ode.**Def.M**ean.**1.A**ssign **RS1**, RSX, EPX, CXX
Mode.**Def.M**ean.**2.A**ssign
etc., up to **.9**
Assignment of the statistics calculations. Valid assignments are a requirement for statistics calculations. In addition, the statistics calculation must be switched on, see 3.2.2.22. Rules for statistics calculations see page 41.

3.2.2.9. **M**ode.**C**Fmla
Mode.**C**Fmla.**1.V**alue **0**...±999 999
Mode.**C**Fmla.**2.V**alue
etc., up to **.19**
Calculation constants specific to a method. Stored in the method memory of the Titrino. Operands specific to the sample (3.2.2.52 and 3.2.2.53) and values of common variables (3.2.2.50) on the other hand are not stored with the methods.

3.2.2.10. **M**ode.**P**arameter.**S**ET1.**E**P pH: 0...±20.00, **OFF**
U, Ipol: 0...±2000, **OFF**
Upol: 0...±200.0, **OFF**
Mode.**P**arameter.**S**ET1.**U**nitEp read only
Parameters for SET: Setting the 1st endpoint as pH value, in mV (with U and Ipol) resp. µA (with Upol). The corresponding unit can be read with .UnitEP. If the value is on "OFF", no further nodes will appear from SET1.

3.2.2.11. **M**ode.**P**arameter.**S**ET1.**D**yn pH: 0.01...20.00, **OFF**
U, Ipol: 1...2000, **OFF**
Upol: 0.1...200.0, **OFF**
Mode.**P**arameter.**S**ET1.**UnitD**yn read only
Mode.**P**arameter.**S**ET1.**M**axRate 0.01...**10**...150, max.
Mode.**P**arameter.**S**ET1.**Mi**nRate 0.01...**25.0**...9999.9
Parameters for SET: Control parameters, see page 25.
.Dyn: Dynamics, control range in pH, mV (with U and Ipol) or µA (with Upol). The corresponding unit can be read with .UnitDyn.
.MaxRate: Maximum allowed titration rate in mL/min. Max. means maximum possible rate with the Exchange Unit in current use.
.MinRate: Minimum titration rate in ul/min.

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

Parameters for SET: Type and size of the stop criterion of the titration.
.Type: Type of stop criterion after stop drift or switch-off delay time.
.Drift: Stop drift in µL/min. Applies when "drift" has been selected.
.Time: Switch-off delay time in s. Applies when "time" has been selected. "inf" means infinite.
.StopT: Stop time in s. Applies when "time" has been selected and the value of .Time is set to "inf.".

3.2.2.13. **M**ode.**P**arameter.**T**itrPara.**D**irection +, -, **auto**

Parameters for SET: 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.

3.2.2.14. **M**ode.**P**arameter.**T**itrPara.**X**Pause **0**...999 999

Parameter for SET: Pause time 1 in s. Is waited off before the dispensing of the start volume.

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

Parameters for SET: Start volume.
If an absolute start volume (abs.) has been selected, the volume in mL is valid.
A relative start volume (rel.) is dispensed as a function of the sample size:
Start volume in mL = smpl size * factor
The factor is valid.
The dispensing rate in mL/min applies to both cases. Max. means maximum possible dispensing rate with the Exchange Unit in current use.

3.2.2.16. **M**ode.**P**arameter.**T**itrPara.**P**ause **0**...999 999

Parameter for SET: Pause time 2 in s. Is waited off after the dispensing of the start volume.

3.2.2.17. **M**ode.**P**arameter.**T**itrPara.**E**xtrT **0**...999 999

Parameter for SET: Extraction time in s.

3.2.2.18. **M**ode.**P**arameter.**T**itrPara.**Me**asInput **1**, 2, diff.
Mode.**P**arameter.**T**itrPara.**I**pol -127...**1**...+127
Mode.**P**arameter.**T**itrPara.**Up**ol -1270...**400**...+1270
Mode.**P**arameter.**T**itrPara.**Po**lElectrTest ON, **OFF**

Parameters for SET:

Selection of the measuring input; valid with measured quantities pH and U. "diff." means differential amplifier, see page 124.
With Ipol, the inquiries for the polarization current in μA (Ipol) and .PolElectrTest are valid.
With Upol, the inquiry for the polarization voltage in mV (Upol) is valid. Entry in steps of 10 mV.
Besides .PolElectrTest is valid.
If the test for polarized electrodes is switched on, it is performed on change-over from the inactive state to an active state (titration or conditioning).

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

3.2.2.20. **M**ode.**P**arameter.**St**opCond.**V**Stop.**T**ype **abs.**, rel., OFF
Mode.**P**arameter.**St**opCond.**V**Stop.**V** 0...**99.99**...9999.99
Mode.**P**arameter.**St**opCond.**V**Stop.**F**actor 0...±**999 999**
Parameter for SET: Stop volume.
If an absolute stop volume (abs.) has been selected, the volume in mL is valid.
A relative stop volume (rel.) is dispensed as a function of the sample size:
Stop volume in mL = smpl size * factor
The factor is valid.
OFF means that the criterion is not monitored.

3.2.2.21. **M**ode.**P**arameter.**S**topCond.**F**illRate 0.01...150, **max.**
Parameter for SET: Filling rate in the titration in mL/min. Max. means maximum possible filling rate with the Exchange Unit in current use.

3.2.2.22. **M**ode.**P**arameter.**Sta**tistics.**S**tatus ON, **OFF**
Mode.**P**arameter.**Sta**tistics.**M**eanN **2**...20
Mode.**P**arameter.**Sta**tistics.**R**esTab.**S**elected **original**, delete n, delete all
Mode.**P**arameter.**Sta**tistics.**R**esTab.**D**elN **1**...20
Entries for the statistics calculations.
.Status: On/off switching. Requirement for statistics calculations is a valid assignment, see 3.2.2.8.
.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.

3.2.2.23. **M**ode.**P**arameter.**P**resel.**C**ond ON, **OFF**
Mode.**P**arameter.**P**resel.**D**riftDisp **ON**, OFF
Parameters for SET:
.Cond: Conditioning ON/OFF
.DriftDisp: Drift display during conditioning ON/OFF.

3.2.2.24. **M**ode.**P**arameter.**P**resel.**DC**or.**T**ype auto, man, **OFF**
Mode.**P**arameter.**P**resel. **DC**or.**V**alue **0.0**, 99.9
Parameters for SET:
.Type: Mode of drift correction
.Value: drift value in µL/min.
If "auto" is set, the actual drift value at the start of titration is used for drift correction.
Formula for drift correction: EP – (drift value * titration time)

3.2.2.25. **M**ode.**P**arameter.**P**resel.**I**Req id1, id1&2, all, **OFF**
Mode.**P**arameter.**P**resel.**S**Req value, unit, all, **OFF**
Parameters for SET, MEAS: Automatic inquiry after the start of the determination. From such an inquiry, the determination continues if the requested entry/entries is/are made, e.g. &SmplData.OFFSilo.Id1 (see 3.2.2.73) or with &M $G, see 3.2.2.1.
$H is not possible in requests.

3.2.2.26. **M**ode.**P**arameter.**P**resel.**A**ctPuls ON, **OFF**
Parameter for SET: first, all, cond., **OFF**
Output of a pulse on the I/O line "Activate", see page 131.

3.2.2.27. **M**ode.**P**arameter.**M**easuring.**S**ignalDrift
pH, U, Ipol, T: 0.5...999, **OFF**
Upol: 0.05...99.9, **OFF**
Mode.**P**arameter.**M**easuring.**U**nitSigDrift read only
Mode.**P**arameter.**M**easuring.**E**quTime 0...9999, **OFF**
Parameters for MEAS: Criteria for the measured value acquisition. Measured value drift in mV/min (with pH, U, Ipol), µA/min (with Upol), resp. °C/min (with T). Equilibration time in s. OFF means that the corresponding criterion is switched off. If both criteria are OFF, the measurement continues indefinitely. If the equilibration time has never been edited, it is automatically calculated by the instrument to match the drift, see page 34. After it has been edited once, it remains in force with the set value.

3.2.2.28. **M**ode.**P**arameter.**M**easuring.**M**easInput **1**, 2, diff.
Mode.**P**arameter.**M**easuring.**I**pol ±127...**1**...+127
Mode.**P**arameter.**M**easuring.**U**pol ±1270...**400**...+1270

Mode.**P**arameter.**M**easuring.**P**olElectrTest ON, **OFF**

Parameters for MEAS:
Selection of the measuring input; valid with measured quantities pH and U. "diff." means differential amplifier, see page 124.
With Ipol, the inquiries for the polarization current in μA (Ipol) and .PolElectrTest are valid.
With Upol the inquiry for the polarization voltage in mV (Upol) is valid. Entry in steps on 10 mV.
Besides .PolElectrTest is valid.
If the test for polarized electrodes is switched on, it is performed on change-over from the inactive state to the measurement.

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

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

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

Parameters for CAL: Selection of the measuring input. "diff." means differential amplifier, see page 124.

3.2.2.31. **M**ode.**P**arameter.**C**alibration.**C**alTemp -20.0...**25.0**...120.0

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

3.2.2.32. **M**ode.**P**arameter.**C**alibration.**B**uffer.**1.V**alue 0...**7.00**...±20.00
Mode.**P**arameter.**C**alibration.**B**uffer.**2.V**alue 0...**4.00**...±20.00, OFF
etc. up to 9 buffers

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

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

Parameters for CAL: Criteria for measured value acquisition. Measured value drift in mV/min, equilibration time in s. OFF means that the corresponding criterion is switched off. If both criterions are on OFF, the measured value is acquired immediately.
If the equilibration time has never been edited, it is automatically calculated by the instrument to match the drift, see page 34. After it has been edited once, it remains in force with the set value.

3.2.2.34. **M**ode.**P**arameter.**C**alibration.**El**ectrodeId up to 8 ASCII char

Parameters for CAL: Electrode identification. It is classified under calibration data, see 3.2.2.59.

3.2.2.35. **M**ode.**P**arameter.**C**alibration.**Sm**plChanger ON, **OFF**

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

3.2.2.36. **M**ode.**P**arameter.**C**alibration.**A**ctPulse first, all, **OFF**
Parameters for CAL: Output of a pulse on the I/O line "Activate", see page 131.

3.2.2.37. **U**serMeth.**F**reeMem read only
Memory space, available for user methods or silo lines. $Q sends the number of free bytes, e.g. "4928".

3.2.2.38. **U**serMeth.**R**ecall $G
UserMeth.**R**ecall.**N**ame up to 8 ASCII characters
UserMeth.**S**tore $G
UserMeth.**S**tore.**N**ame up to 8 ASCII characters
UserMeth.**D**elete $G
UserMeth.**D**elete.**N**ame up to 8 ASCII characters
UserMeth.**DelA**ll $G
Management of the internal method memory: Load, store and delete methods. An action is performed if "$G" is sent to the corresponding node just after entering the name.
Do not use blank characters before and after method name!
.DelAll: Deletes all methods in the user memory.

3.2.2.39. **U**serMeth.**L**ist.**1.N**ame read only
UserMeth.**L**ist.**1.M**ode read only
UserMeth.**L**ist.**1.Q**uantity read only
UserMeth.**L**ist.**1.B**ytes read only
UserMeth.**L**ist.**1.C**hecksum read only
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
.Bytes: Number of bytes of the user memory used by the method
.Checksum: Checksum of the method, see 3.2.2.59.

3.2.2.40. **C**onfig.**P**eriphUnit.**C**harSet Epson, Seiko, Citizen, HP, **IBM**
Selection of the character set and the graphics control characters of the Titrino.
IBM means the IBM character set following character set table 437 and IBM graphics control characters. Select 'IBM' for work with the computer.

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

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

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

Selection of the dialog language.

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

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

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

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

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

Number of automatic, internal starts.

3.2.2.46. **C**onfig.**A**ux.**St**artDelay **0**...999 999

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

3.2.2.47. **C**onfig.**A**ux.**D**evName up to 8 ASCII characters

Name of the instrument for connections with several units. It is advisable to use only the letters A...Z (ASCII No. 65...90), a...z (ASCII No. 97...122) and the numbers 0...9 (ASCII No. 48...57) when the function Setup.AutoInfo (3.2.2.86) is used at the same time.
If a name has been entered, it will be printed out in the result report (full, short).

3.2.2.48. **C**onfig.**A**ux.**P**rog read only

Output of the program version.
The Titrino sends "719.0021" on requests with $Q.

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

$G sets all RS settings. The changes are performed only if the instrument is inactive. After the setting of the interface parameters, wait at least 2 s to allow the components to equilibrate.
Settings of the values for the data transmission via the RS interface: baud rate, data bit, stop bit, parity and type of handshake, see also page 95ff.
The setting of the values must be initiated with $G immediately after entry of the values.

3.2.2.50. **C**onfig.**C**omVar.**C30**
with up to **.C39**, etc. 0... ±999 999
Values of the common variables from C30 up to C39. Insert the common variables directly or describe the determination results directly from the method, see 3.2.2.6.

3.2.2.51. **S**mplData.**S**tatus ON, **OFF**
On/off switching of silo memory. When the silo memory is switched on, the sample data are fetched from the lowest valid silo line.

3.2.2.52.

SmplData.**O**FFSilo.**I**d1	up to 8 ASCII characters
SmplData.**O**FFSilo.**Id2**	up to 8 ASCII characters
SmplData.**O**FFSilo.**Id3**	up to 8 ASCII characters
SmplData.**O**FFSilo.**V**alSmpl	6-digits, sign and decimal point
SmplData.**O**FFSilo.**U**nitSmpl	up to 5 ASCII characters

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

3.2.2.53.

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

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

3.2.2.54.

SmplData.**ON**Silo.**E**ditLine.**1.M**ethod	up to 8 ASCII characters
SmplData.**ON**Silo.**E**ditLine.**1.I**d1	up to 8 ASCII characters
SmplData.**ON**Silo.**E**ditLine.**1.Id2**	up to 8 ASCII characters
SmplData.**ON**Silo.**E**ditLine.**1.Id3**	up to 8 ASCII characters
SmplData.**ON**Silo.**E**ditLine.**1.V**alSmpl	6-digits, sign and dec.point
SmplData.**ON**Silo.**E**ditLine.**1.U**nitSmpl	up to 5 ASCII characters
etc., up to **.99**	

Contents of a silo line.
.Method: Method used to process the sample, from the method memory or from the card.
.Id: The identifications Id1...Id3 can also be used as sample-specific calculation constants C21...C23 in formulas.

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

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

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

3.2.2.56. **S**mplData.**ON**Silo.**DelA**ll $G

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

3.2.2.57. **S**mplData.**ON**Silo.**Cy**cleLines ON, **OFF**

Silo data cycling.
With "ON", executed lines are copied to the next free silo lines, see page 53.
Exercise caution if you edit the silo memory during the determinations!

3.2.2.58. **I**nfo.**R**eport $G
Info.**R**eport.**S**elect configuration, parameters, smpl data, statistics, silo, calib, C-fmla, def, user method, **full**, short, calc, all, ff

$G sends the selected report to the COM which is set in &Config.PeriphUnit.RepToComport:
configuration: Configuration report. Is not accessible during a running determination.
parameters: Parameter report of the current method. During a running determination only "live"-parameters are accessible.
smpl data: Current sample data.
statistics: Statistics table with the individual results.
silo: Contents of the silo memory.
calib: Calibration data of the measuring input in the current method.
C-fmla: Contents of the <C-fmla> key.
def: Contents of the <def> key.
user method: Contents of the method memory.
full: Full result report of the last completed determination.
short: Short result report of the last completed determination.
calc: Calculation report of the current method.
all: All reports.
ff: Form feed on printer.
Reports which are sent from the Titrino are marked with space (ASCII 32) and ' at the beginning. Then an individual identifier for each report follows. Reports which are triggered by RS232 ($G) have the same introducer but without preceding space, i.e. they start with '.

3.2.2.59. **I**nfo.**C**alibrationData $G
Info.**C**alibrationData.**I**np1.**p**Has -20.00...**7.00**...+20.00
Info.**C**alibrationData.**I**np1.**S**lope -9.999...**1.000**...+9.999
Info.**C**alibrationData.**I**np1.**T**emp -170.0...**25.0**...+500.0

Info.**C**alibrationData.**I**np1.**D**ate read only
Info.**C**alibrationData.**I**np1.**E**lectrodeId read only
identical for .Inp2 and .Diff

pH calibration data for measuring input 1. After the calibration, the data are entered automatically together with the date of the calibration and the electrode identification, see 3.2.2.34.
Calibration data can be entered. They are accepted with &Info.CalibrationData $G. If calibration data are entered, the calibration date is deleted.

3.2.2.60. **I**nfo.**Ch**ecksums $G
Info.**Ch**ecksums.**A**ctualMethod read only

The checksums can be used to identify the content of a file unequivocally, e.g. files with identical content
have identical results of the checksums. An empty file has checksum "0". The calculation of the checksums is triggered with $G.
.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.

3.2.2.61. **I**nfo.**D**etermData $G
Info.**D**etermData.**W**rite ON, **OFF**
Info.**D**etermData.**E**xV read only/read+write

Recalculation of the measuring data is triggered with $G.
.Write: With "ON", the following nodes can be overwritten: &Info.TitrResults.Var.C4X (X = 0...5) and &Mode.Name.
.ExV: Volume of the exchange unit, with which the determination was executed

3.2.2.62. **I**nfo.**T**itrResults.**R**S.**1.V**alue read only
etc., up to **.9**
Info.**T**itrResults.**E**P.**1.V** read only
Info.**T**itrResults.**E**P.**1.M**eas read only
etc., up to **.2**
Info.**T**itrResults.**V**ar.**C**40 read only/read+write
etc., up to **.C47**

.RS: Values of the calculated results.
.EP: Endpoints with SET:
Volume coordinate in mL, e.g. "1.2340"
Measured value coordinate in pH "5.12", mV (with U and Ipol) "-241" or µA (with Upol) "43.7".
.Var: Various variables. You may overwrite the variables C40...C45, see 3.2.2.95.
C40: Initial measured value in pH "5.12", mV (with U and Ipol) "41", µA (with Upol) "43.7" or °C (with T) "25.0". In MEAS final measured value.
C41: End volume with SET in ml, "12.5360".
C42: Time from start of titration to end in s, "62".
C43: Volume drift on start of a SET titration from the conditioning in ul/min, "3.5".

C44: (Last measured) temperature in °C. Used for the temperature compensation in pH measurements.
C45: Start volume with SET in ml, "2.800".
C46: Asymmetry pH of CAL, "6.89".
C47: Relative electrode slope of CAL, "0.9950".

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

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

3.2.2.64. **I**nfo.**A**ctualInfo.**I**nputs.**S**tatus read only
Info.**A**ctualInfo.**I**nputs.**C**hange read only
Info.**A**ctualInfo.**I**nputs.**Cl**ear $G
Info.**A**ctualInfo.**O**utputs.**S**tatus read only
Info.**A**ctualInfo.**O**utputs.**C**hange read only
Info.**A**ctualInfo.**O**utputs.**Cl**ear $G

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

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

Output: $2^1 + 2^3 =$ "10"
1 means ON or change; 0 means OFF or no change.
The lines are assigned as follows (see also pages 129ff):

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

3.2.2.65. **I**nfo.**A**ctualInfo.**A**ssembly.**C**yclNo read only
$Q sends the current cycle number of the voltage measurement cycle, e.g. "127". From the cycle number and the cycle time (see 3.2.2.71), 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.

3.2.2.66. **I**nfo.**A**ctualInfo.**A**ssembly.**Co**unter.**V** read only
Info.**A**ctualInfo.**A**ssembly.**Co**unter.**C**lear $G
$Q sends the volume. With the function &Info.Assembly.Counter.Clear $G, the volume counter is set to zero.

3.2.2.67. **I**nfo.**A**ctualInfo.**A**ssembly.**M**eas read only
Info.**A**ctualInfo.**A**ssembly.**P**istonPos read only
$Q sends the current measured value from the assembly.
Piston position: 0 = initial position (filled)
10 000 = end position (empty)

3.2.2.68. **I**nfo.**A**ctualInfo.**T**itrator.**C**yclNo read only
Info.**A**ctualInfo.**T**itrator.**V** read only
Info.**A**ctualInfo.**T**itrator.**M**eas read only
Info.**A**ctualInfo.**T**itrator.**d**Vdt read only
Info.**A**ctualInfo.**T**itrator.**dM**easdt read only
Info.**A**ctualInfo.**T**itrator.**dMeasdV** read only
$Q sends the current values in the following formats:

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

NV: Not Valid. If in the signal drift is OFF in modes MEAS and CAL, the signal drift is NV.
OV will be sent for "overrange".
A time frame can be set up from the cycle number and the cycle time (see 3.2.2.71). The cycle number is set to 0 at the start of a method and it is incremented until the end of the method.

3.2.2.69. **I**nfo.**A**ctualInfo.**E**P.**I**ndex read only
Info.**A**ctualInfo.**E**P.**X** read only
Info.**A**ctualInfo.**E**P.**Y** read only
.EP.X"1.234" Volume coordinate of the EP
.EP.Y"5.34" Measured value coordinate of the EP

3.2.2.70. **I**nfo.**A**ctualInfo.**D**isplay.**L**1 up to 24 ASCII characters

Info.**A**ctualInfo.**D**isplay.**L2** up to 24 ASCII characters

Lines of the display. The display can be written to from the computer. Proceed as follows:
Lock the display, see 3.2.2.80.
$Q sends the contents of the corresponding display line.

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

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

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

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

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

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

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

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

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

Measurement in assembly. The measuring function can only be started via RS Control. When the measuring function is switched on, no method can be started at the Titrino.
.Input: Selection of the potentiometric measuring input 1, 2, diff., polarized electrodes or temperature.

.Ipol: Polarization current in µA.
.Upol: Polarization potential in mV, entry in steps of 10 mV.

3.2.2.76. **A**ssembly.**O**utputs.**A**utoEOD **ON**, OFF
Assembly.**O**utputs.**S**etLines $G
Assembly.**O**utputs.**S**etLines.**L**0 active, inactive, pulse, **OFF**
up to .L 3
Assembly.**O**utputs.**R**esetLines $G

Setting the I/O output lines.
.AutoEOD: The automatic output of the EOD (End of Determination) at the end of the determination can be switched off. Thus, for example, in conjunction with a Titrino several determinations can be performed in the same beaker. Before AutoEOD is switched on, line 3 must be set to "OFF".
.SetLines: With $G, all lines are set.
.SetLines.LX: Set the line LX. "active" means setting of a static signal, "inactive" means resetting of the signal, "pulse" means output of a pulse of app. 150 ms, "OFF" means the line is not operated, see also page 130.

Warnings:

- L2 is the EOD line. If you have "AutoEOD" set to "ON", an active line 2 is set to "inactive" by the EOD pulse.
- L3 is the line of the activate pulse. An active line 3 is set to "inactive" by the activate pulse.

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

3.2.2.77. **Se**tup.**K**eycode ON, **OFF**

ON means the key code of a key pressed on the Titrino is outputted. The key code comprises 2 ASCII characters; table of the keys with their code, see page 108. A keystroke of key 11 is sent as follows:

#11

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

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

Definition of the type of answer to $Q.
.Short: With "ON", each path is sent with only the necessary amount of characters in order to be unequivocal (printed in bold in this manual). A combination of .Short and .ChangedOnly is not possible.
.ChangedOnly: Sends only the changed values, i.e. values which have been edited. All paths are sent absolute, i.e. from the root.

3.2.2.79. **Se**tup.**Tra**ce ON, **OFF**

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

&SmplData.OFFSilo.Id1"Trace"

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

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

ON means disable the corresponding function:
.Keyboard: Disable all keys of the Titrino
.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.

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

Holding points in the method sequence. If they are "ON", the sequence stops until "OFF" is sent. Switching the instrument on sets both nodes to OFF:
.StartWait: Holding point right after starting a method or submethod in TIP (holding point after AutoInfo !".T.GC").
.FinWait: Holding point at the end a method or submethod in TIP (holding point after AutoInfo !".T.F").

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

.SendStatus: ON means the automatic transmission of measured values (see 3.2.2.84 and 3.2.2.85) in the inputted interval is active.
.Interval: Time interval (in s) for the automatic transmission of associated measured values defined under points 3.2.2.84 and 3.2.2.85. 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.

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

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

Selection of the unit of which the measured values should be sent (3.2.2.84 or 3.2.2.85).

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

Selection of the values from Assembly for the output in the set time interval (see 3.2.2.82):

.CyclNo: Cycle number of the potential measurement. Together with the cycle time (3.2.2.81), 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 3.2.2.83).

3.2.2.85.

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

Selection of the values from the titrator which are sent in the set time interval (see 3.2.2.82, formats see 3.2.2.68):

.CyclNo: Cycle number. Together with the cycle time (3.2.2.71), 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

.dVdt: associated volume drift.

.dMeasdt: associated measured value drift.

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

The unit "titrator" must be preset (see 3.2.2.83).

3.2.2.86.

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

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

.Status: Global switch for all set AutoInfo.

.P PowerOn: Simulation of power on (3.2.2.87). 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 has received a go command.

.T.S Stop: Status 'Stop' has been reached.

.T.B Begin of sequence.

.T.F Final: End of determination, the final steps will be carried out.

.T.E Error. Message together with error number, see page 60ff.

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

.T.C Continue: Continue after hold.

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

.T.N Conditioning Not OK: EP not reached (in SET with conditioning).

.T.Re Request: In the inquiry of an identification or the sample size after start of titration.

.T.Si SiloEmpty: Silo empty, i.e. the last line has been removed from the silo memory.

.T.EP EPList: Entry into EP list (with SET)

.T.RC Results have been recalculated.

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

.I Input: Change of an input line.

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

If a change occurs that requires a message, the Titrino sends space (ASCII 32) and ! as an introducer. This is followed by the name of the device (see 3.2.2.47). Special ASCII characters in the device name are ignored. If no device name has been entered, only ! is sent. Finally the Titrino sends the information which node has triggered the message.

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

3.2.2.87. **Se**tup.**P**owerOn $G

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

3.2.2.88. **Se**tup.**I**nitialise $G

Setup.**I**nitialise.**S**elect **ActMeth**, Silo, Calib, Config, Assembly, Setup, All

Setting of default values for the following areas:

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

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

Calib: pH calibration data for all measuring inputs.

Config: All values under &Config.

Assembly: All values under &Assembly.

Setup: All values under &Setup.
All: Values of the entire tree (except silo and method memory).
The action must be triggered with &Setup.Initalise $G.

3.2.2.89. Setup.**R**amInit $G

Initializes instrument, see page 116. 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.

3.2.2.90. Setup.**Ins**trNo $G
Setup.**Ins**trNo.**V**alue **serial number**, 8 ASCII characters

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

3.2.2.91. Diagnose.**R**eport $G

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

3.3 Properties of the RS 232 Interface

Data Transfer Protocol

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

The RS 232 interface has the following technical specifications:

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

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

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

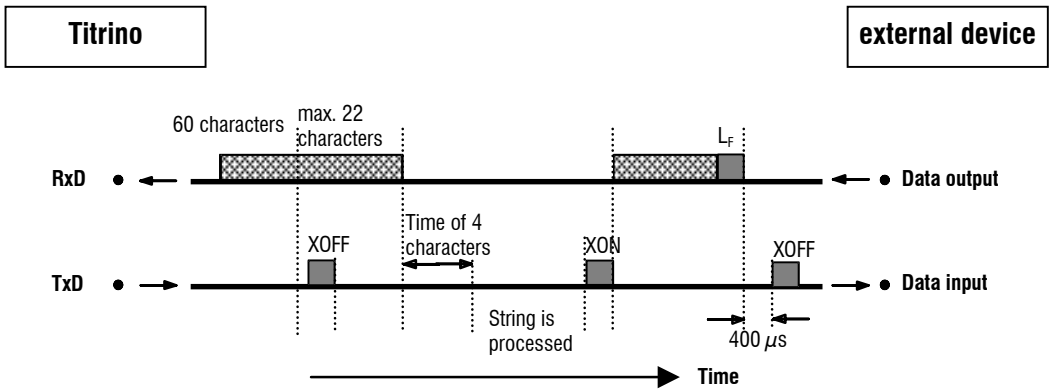
3.3.1 Handshake

Software-Handshake, SWchar

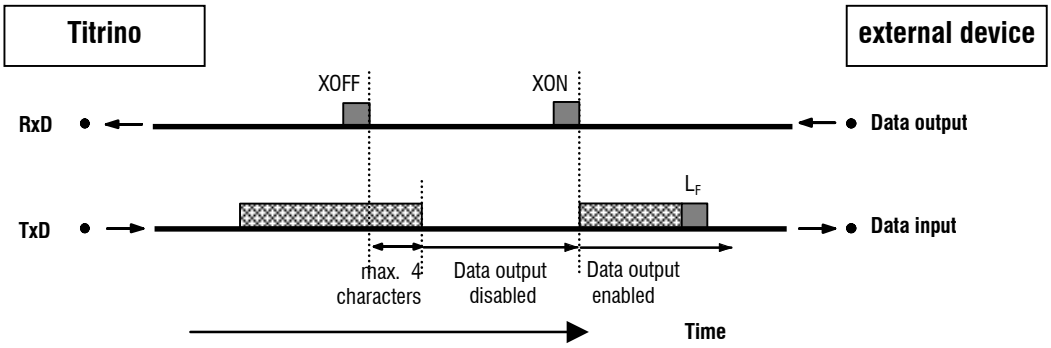
Handshake inputs on the Titrino (CTS, DSR, DCD) are not checked.
Handshake outputs (DTR, RTS) are set by the Titrino.

As soon as a L_F is recognized, the Titrino sends XOFF. It can then receive 6 extra characters and store them.
However, the Titrino also sends XOFF if its input buffer contains 60 characters. After this, it can receive maximum 22 extra characters (incl. L_F).
If the transmission is interrupted for the time of 4 characters after the Titrino has sent XOFF, the string received earlier is processed even if no L_F has been sent.

Titrino as Receiver :



Titrino as Sender :

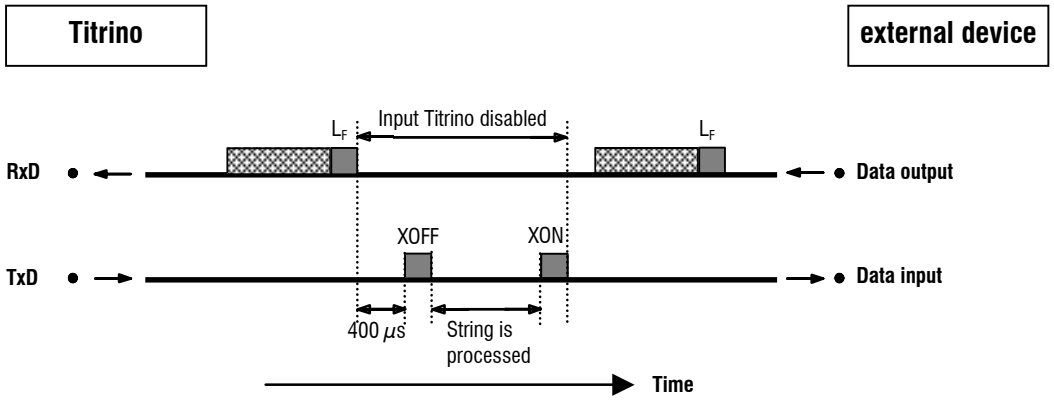


Software-Handshake, SWline

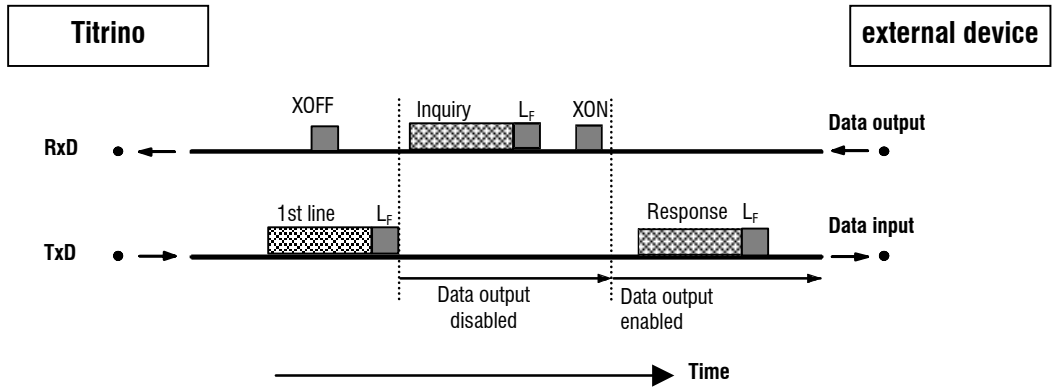
Handshake input ports on the Titrino (CTS, DSR, DCD) are not checked. Handshake output ports (DTR, RTS) are set by the Titrino.

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

Titrino as Receiver :



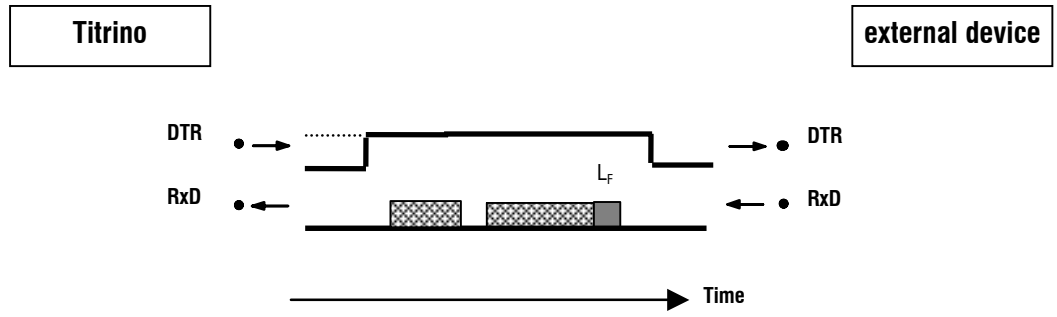
Titrino as Sender:



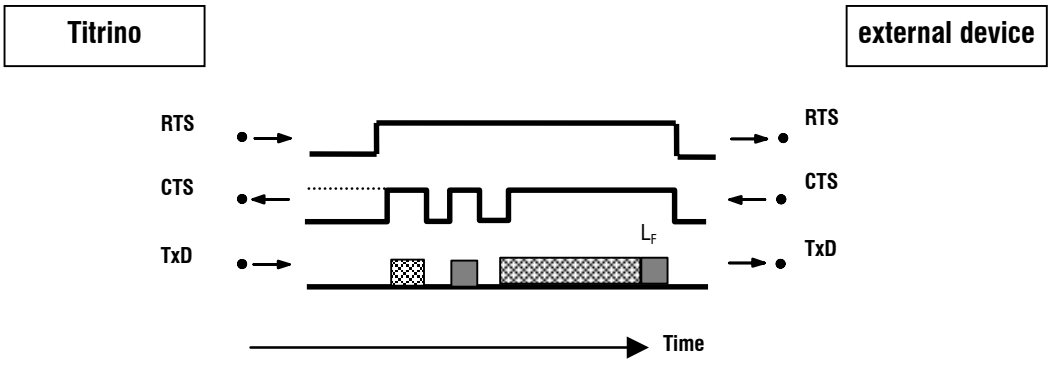
Titrino transmission can be stopped by external instruments with XOFF. After XOFF is received the Titrino completes sending the line already started. If data output is disabled for more than 3 s by XOFF, E43 appears in the display.

Hardware-Handshake, HWs

Titrino as Receiver :



Titrino as Sender:

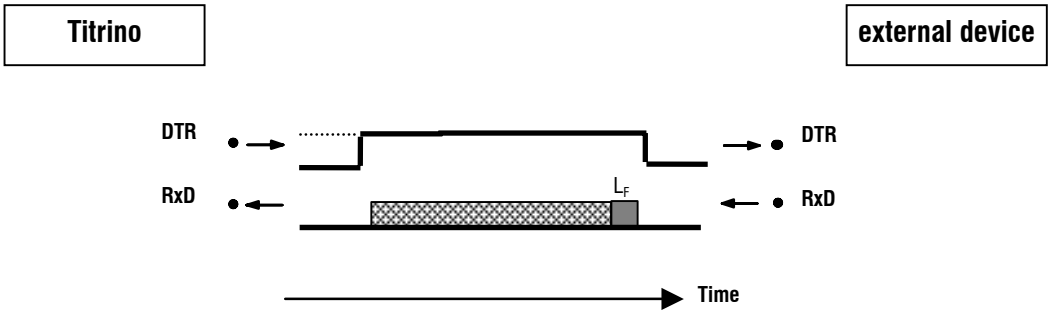


The data flow can be interrupted by deactivating the CTS line.

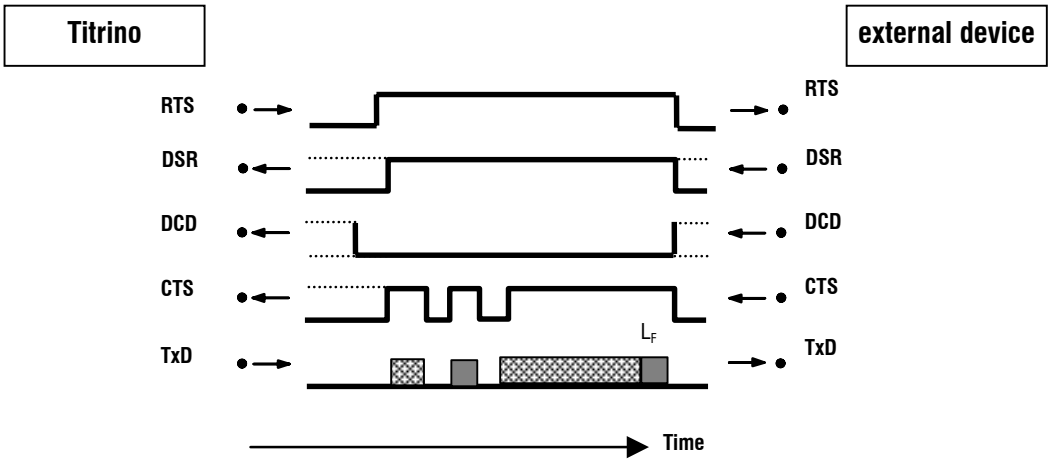
Hardware-Handshake, HWf

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

Titrino as Receiver :



Titrino as Sender:



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

3.3.2 Pin Assignment

RS232C Interface

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

Received Data (RxD)
Data are received only when DCD is "ON".

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

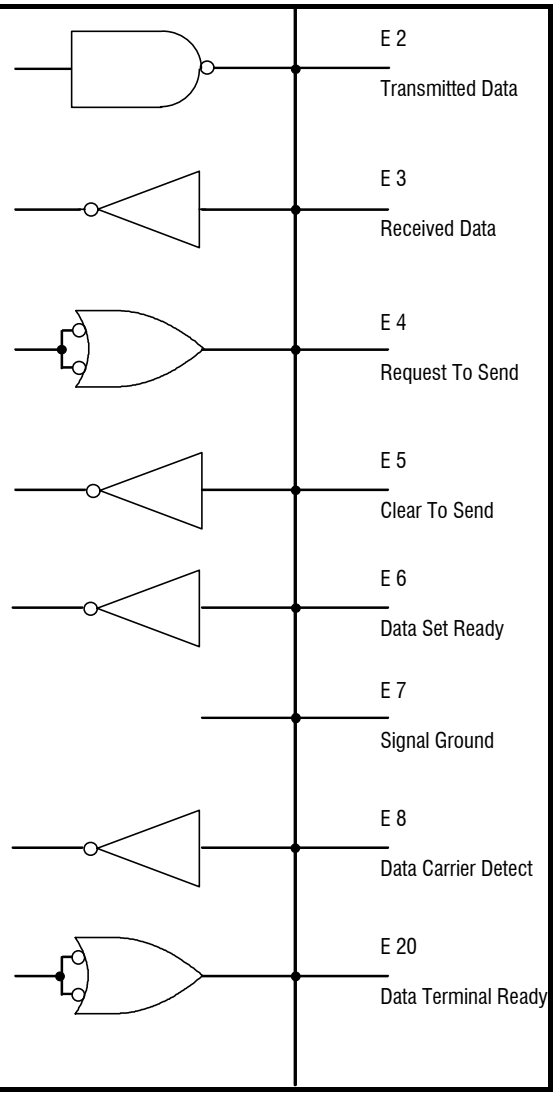
Clear to Send (CTS)
ON condition: Remote station is ready to receive data.

Data Set Ready (DSR)
ON: Condition: The transmission line is connected.

Signal ground (GND)

Data Carrier Detect (DCD)
ON condition: The level of the received signal is within the tolerance range (remote station is ready to send data).

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



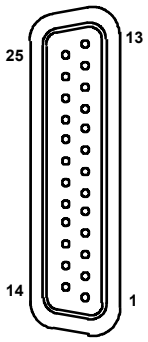
Protective earthing
Direct connection from cable plug to the protective ground of the instrument.

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

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

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

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



View of soldered side of plug

Ordering numbers:
K.210.9004 and K.210.0001

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

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

Problem	Questions for remedial action
No characters can be received on a connected printer.	- Are the instruments switched on and cables plugged in correctly? - Is the printer set to ”on-line”? - Are baud rate, data bit and parity the same on both instruments? - Is the handshake set properly? If everything seems to be ok, try to print a report with the key sequence <PRINT><SMPL DATA><ENTER>. If this report is printed out correctly, check if reports are defined in key <DEF>.
No data transmission and the display of the Titrino shows an error message.	- **error 42**: Transmission error. Is the printer set to "on-line"? Is the connection cable properly wired? - **error 43**: Data output of the Titrino disabled for longer than 6 s by XOFF. - **error 36-39**: Receive error. Are the RS settings the same on both devices?
The received characters are garbled.	- Are the RS settings the same on both devices? - Has the correct printer been selected? - Data transfer has been interrupted on the hardware side during the printout of a curve. Re-establish connections and switch printer off/on.
Wrong line spacing.	The printer does not emulate completely the preset mode. Usually these problems arise with the IBM mode. Set the printer to a different mode (e.g. Epson).
Printout of titration curve is not ok. Other reports are printed ok.	Handshake is necessary for the printout of curves. - Is your cable correctly wired? (The DTR of the printer has to be connected to the CTS of the Titrino.) - Set "HWs" for the handshake of the Titrino. Configure the printer such that its DTR is set (possibly with DIP switches).

4 Error messages, Troubleshooting

Data transfer inoperative See measures on page 101.

4.1 Error and special messages

XXX bytes missing
XXX bytes missing. For the storage of a method or a silo line XXX bytes are missing.
Remedy: <QUIT>. Delete methods no longer needed or use fewer silo lines.

check electrode
With polarized electrodes. There is a break or short circuit.
Possible causes and rectification of the fault:
- the electrode is not plugged in ⇒ plug it in
- the electrode is not immersed in the solution ⇒ immerse it
- the electrode is defective ⇒ use new electrode.
- the electrode cable is defective ⇒ use new cable.
The electrode test can be switched off under the <PARAM> key.
Exit: Rectify fault or <STOP>.

check exchange unit
The Exchange Unit is not mounted (properly).
Exit: Mount Exchange Unit (properly) so that the coupling engages or <STOP>.

check T-sensor
No temperature sensor is attached (with MEAS T or if the temperature monitoring is active).
Exit: Connect Pt100 or Pt1000 or <STOP>.

division by zero
The result could not be calculated as a divisor in the formula was equal to zero.
Exit: Enter appropriate value.

manual stop
The determination has been manually stopped.

missing EP
An EP needed for calculation in a formula is missing.

no EP set
In SET, no EP has been set.
Exit: <STOP> and set EP.

no method
The method required by the sample data from the silo memory or in a TIP sequence is not available in the method memory.
Exit: <CLEAR>.

no new com.var.
The common variable could not be assigned as the result or the mean value could not be calculated. The old value remains in force.

no new mean
No new mean value has been calculated as at least one quantity stipulated for mean value calculations could not be calculated.

not valid
A value is not available.

overrange
The measuring range of ±2 V has been exceeded. Overrange replaces the corresponding measured value (pH, U, I or temperature).
Exit: Rectify error, <STOP> or >MEAS/HOLD>.

same buffer
In the calibration sequence the voltage difference between the first and second buffer is < 6 mV.
Exit: <QUIT> and change buffer or <STOP> (abort calibration).

silo empty	The silo memory is switched in but empty and a titration has been started. Corrective action: At least the first 1 silo line before starting the first titration. Exit: <CLEAR>.
silo full	The silo memory is full up. Corrective action: If you have filled less than 99 silo lines, you can create more space by deleting old methods no longer needed. 1 silo line needs 18...90 bytes. Exit: <CLEAR>.
stop time reached	SET has been stopped as the stop time has been reached.
stop V reached	The determination has been stopped as the stop volume has been reached.
system error 3	The instrument adjustment data have been overwritten. Exit: <CLEAR>. Default adjustment data are set. The error message appears each time the instrument is switched on until it has been readjusted (Metrohm service).
wrong sample	With SET, with preset titration direction the first measured value is outside the end point.

Error messages in connection with the data transfer

If neither a computer nor a printer is attached, the report output at the end of the titration must be switched off:

Receive errors:

E36	Parity Exit: <QUIT> and set corresponding quantity the same on both instruments
E37	Stop bit Exit: <QUIT> and set corresponding quantity the same on both instruments
E38	Overrun error. At least 1 character could not be read. Exit: <QUIT>
E39	Overflow of the receive buffer of the Titrino (> 82 characters). Exit: <QUIT>

Send errors:

E40	DSR=OFF
E41	DCD=OFF
E42	CTS=OFF Handshake unsatisfactory for more than 1 s.

	Exit: <QUIT> Is the receiver switched on and ready to receive?
E43	The transmission of the Titrino has been interrupted with XOFF for at least 3 s. Exit: <QUIT>.
E44	The RS interface parameters are no longer the same for both instruments.
E45	The receive buffer of the Titrino contains an incomplete string (missing L_F). Transmission of the Titrino is thus blocked. Exit: Send L_F or <QUIT>.

4.2 Diagnosis

4.2.1 General

The 719 S Titrino is a very precise and reliable instrument. Thanks to its rugged construction it is virtually impossible for external mechanical or electrical influences to have an adverse effect on its functions.

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

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

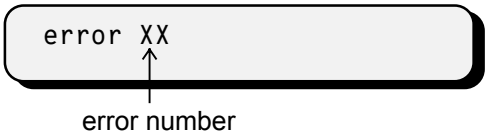
In inquiries always quote the manufacturing (page 4) and program number (see configuration, page 22) and specify possible error displays..

4.2.2 Procedure

- The diagnostic steps must be performed in sequence and compared with the reactions of the 719 S Titrino (indented). In the "yes" case, continue with the next instruction.
- If the instrument does not show the expected reaction ("no" case), the appropriate diagnostic step must be repeated to exclude an operating error. With repeated wrong reactions, however, there is a strong possibility that a malfunction exists.
- The diagnostic steps allow re-entry into the test routine for repetition if the following display appears:

If the instrument is in a subprogram of the diagnostic routine: Press <Clear>.
If need be, switch the power off then on again after a few seconds. At the same time press key <9> until the above display appears.

- If <Clear> has been pressed during the display of **'diagnose press key 0...9'**, the instrument returns to the user program.
- Error display: An error is shown in the display as follows:



- If a fault causes the burette drive to stick at the top or bottom end of the cylinder, see page 117, point 4.4.

4.2.3 Equipment required:

- *voltage calibrator, e.g. 1.773.0010 Metrohm pH Simulator*
  or 1.767.0010 Calibrated Reference for mV, pH, Ω µS, °C
- *highly insulated interconnection cable 6.2108.060*
- *cable 3.496.5070*
- *exchange units, if possible with different cylinder volumes (or 3.496.0070 dummy exchange unit)*
- *stop watch or watch with second hand*
- *digital or analogue voltmeter (if need be, connect a calibrated recorder)*
- *2 connecting cables with 4 mm banana plugs*
- *test plug 3.496.8510 (necessary only if plug 'Remote' should be checked)*
- *test plug 3.496.8480 (necessary only if plug 'RS 232' should be checked)*

4.2.4 Diagnosis steps

1 Prepare instruments for diagnostic test

- Power off.
- Disconnect all external connections (cables at rear, except mains cable and keyboard).
- Remove exchange unit.
- Power on and immediately press and hold the **<9>** key until the power up test pattern disappears.

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

2 Perform display test

- Press **<2>**.

```
display test
```

- Press **<Enter>**.

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

Test sequence:

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

b) The display is cleared and both lines are written into with the letters A, B, C,…Z.

c) The complete character set is shown as a moving display. At the same time with moving display the LED's „STATISTICS" and „SILO" are swtiches on and off.

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

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

3 Keypad test

- Press **<1>**.

```
keys test
```

- Press **<Enter>**.

```
keys test
matrix code
```

- If any key is now pressed (on the 6.2132.110 keypad or on the fron panel of the 719), the appropriate matrix code appears in the display.

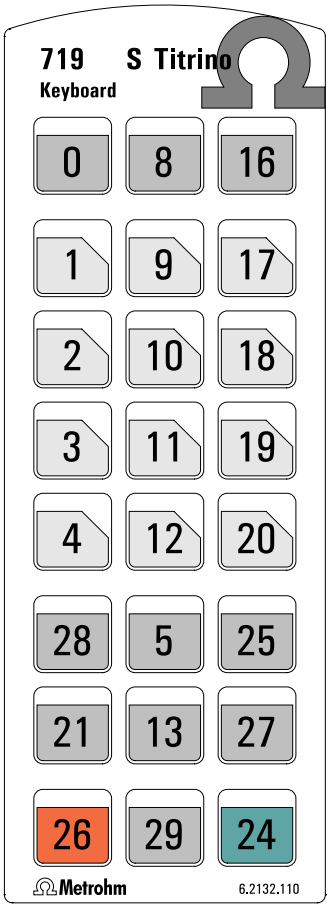


Fig. 1 Keypad 719

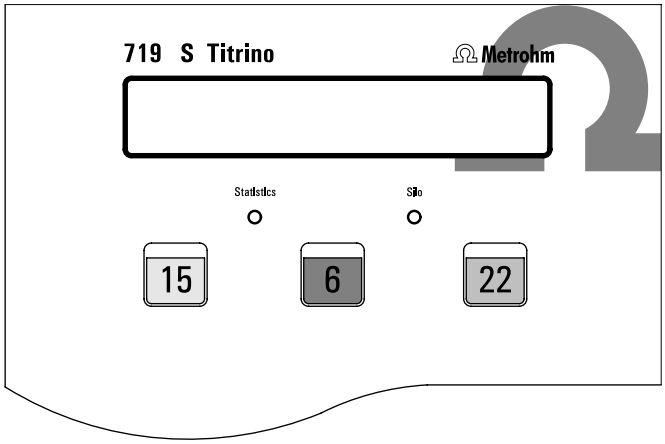


Fig. 2 Front panel 719

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

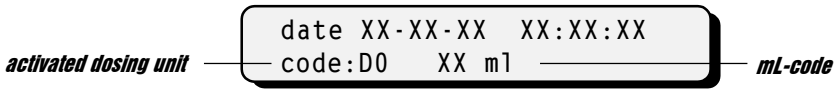
```
diagnose press key 0...9
```

4 Cylinder code, date, time

- Put exchange unit or dummy on the Titrino and put the burette tip into a collecting receptacle.
- Press **<0>**.

```
date/time
cylinder code
```

- Press **<Enter>**.



- Check date and time.
- Check whether the mL-code does correspond with the exchange unit placed or not.
  For the sake of completeness, different exchange units can be inserted to check their mL code. If desired, the exchange unit can be removed again. If no exchange unit is inserted display does not show the mL-code but „check exchange unit !“.
- Press **<Clear>**.

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

5 Analogue output test

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

- Connect a voltage measuring instrument (voltmeter, DVM, recorder) to the analogue output ***(10)***.
- Press **<3>**.

```
analog output-1 test
```

- Press **<Enter>**.

```
analog output-1 test
V-out =              XXmV
```

Enter a voltage value in the range ± 2000 mV using the keypad. After the <ENTER> key has been pressed, this value appears as a voltage at the analog output..

Read off value an the connected voltmeter and compare with the mV value on the display. (Tolerance ± 2 mV)

- Press **<Quit>**.
- Disconnect voltmeter.

6 Motor timer test

- Press **<6>**.

```
motor-timer test
```

- Press **<Enter>**.

```
pot.meter dV/dt ➜ 10?
```

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

Test sequence:

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

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

c) If no error is found, after about 3 s it appears

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

- Press **<Clear>**.

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

7 Analogue input test

- Press **<7>**.

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

7.1 Examination of highly insulated measuring inputs

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

```
Input 1          0.0 mV
```

Tolerance: ± 0.5 mV

- Set the calibrator voltage, on setting 'low ohmic' (with 773 = ~ 0.002 MΩ) to different values (e.g. +1500 mV) and compare with the displayed value.

Tolerance (with ± 1500 ÷ 2000 mV) ± 1 mV. Be aware of the calibrator's tolerance.

- Set simulator to high ohmic condition (with 773 = 1000 MΩ).

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

- Press **<Clear>**.

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

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

```
Input 2            XX mV
```

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

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

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

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

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

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

- Remove cables from the inputs 'Ind I' and 'Ind II'.
- Press **<Clear>**.

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

7.2 To check Pt 100 / 1000 connection

- Connect a Pt 100 or Pt 1000 sensor, a resistor switch-box or a single resistor of 100 Ω or 1 kΩ, respectively, to sockets 'Pt 100/1000' by means of short cables.
- Press **<4>**.

```
Pt 100*            XX °C
```

(* or Pt 1000)

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

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

- Press **<Clear>**.

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

- Remove cables and resistor switch-box.

7.3 Polarizer test

- Press **<5>**.

```
polarizer test
```

- Press **<Enter>**.

```
dummy resistor 14.3kΩ ?
```

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

Test sequence:

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

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

- Press **<Clear>**.

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

- Press **<Clear>.**

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

- Remove cable and resistor switch-box.

8 External inputs and outputs

This test is meaningful only if the 719 S Titrino is used interconnected with other instruments via the 'Remote' connection. In addition, a 3.496.8510 test plug normally used in the repair service is required for this test. However, this plug can also be purchased by customers under the above number.

For the sake of completeness, the procedure is described here. If a diagnostic test of the external inputs and outputs is not required, continue with point 9.

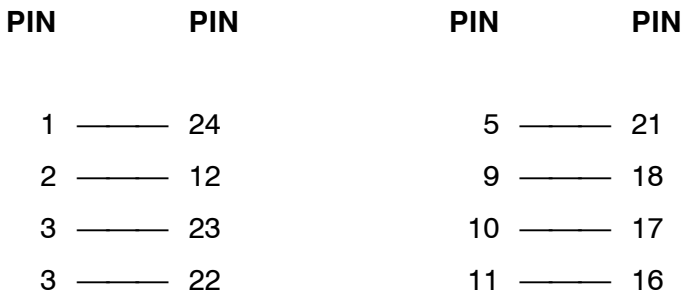


Fig. 3 Connections in the 3.496.8510 test plug

- Press **<4>**

```
extern input/output test
```

- Press **<ENTER>**.

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

- Insert the 3.496.8510 test plug in port B 'Remote'. (Do not switch off instrument!)
- Press **<ENTER>**.

Test sequence:

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

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

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

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

9 RS 232 test

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 RS 232 interface is not required, continue with point 10.

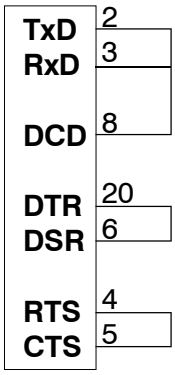


Fig. 4 Connections in the 3.496.8480 plug

- Press **<5>**.

```
RS232 test
```

- Press **<ENTER>**.

```
RS232 test-connector?
```

- Insert the 3.496.8480 test plug in 'RS 232' port.
- Press **<Enter>**.

Test sequence:

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

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

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

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

10 Spindle drive and stopcock changeover

- Press **<Clear>**.

The Titrino fills (only if an exchange unit is inserted)

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

- Remove exchange unit.
- Check spindle zero position, see Fig. 5.

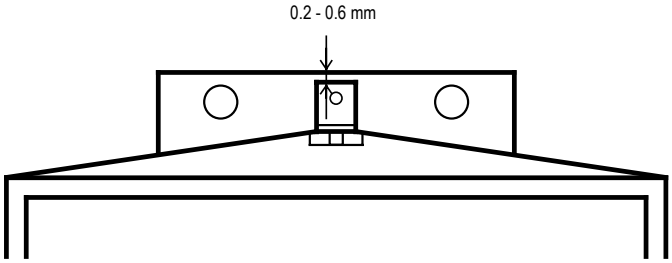


Fig. 5

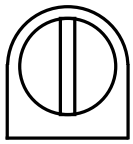


Fig. 6

The spindle must be 0.2 - 0.6 mm below the edge of the sliding plate.

The bar of the stopcock coupling must be exactly parallel to the lateral edges of the MPT Titrino, see Fig.6.

- Reinsert Exchange Unit.

Titrino fills.

The display of before reappears.

- Knob '**dV/dt**' to right stop.
- Press the **<DOS>** key (on instrument) until the piston rod reaches the top and at the same time measure the time from start to end.

```
XXX X          ********
cylinder empty !
```

mind selected language!

Spindle remains at maximum position. The transit time of the spindle is 20 s.

- Measure spindle lifting (can be performed only if the 3.496.0070 Dummy Exchange Unit is inserted or the locking switch (in right hole) is carefully operated with a screwdriver after removal of the Exchange Unit).

  From the start point, the spindle travels 80 mm. Instead of the spindle height, the expelled volume can be measured (corresponds to max. vol. of Exchange Unit used).

- Press **<FILL>** (on instrument) and simultaneously measure the time until the Titrino is again in the 'ready' position.

  Times for filling: per stop cock cycle 1 s
  for filling 20 s (Tolerance: 10 %)

  The following generally holds: Spindle and stopcock must move at a constant speed (noise!). In the filling setting, the stopcock coupling must position the lever of the Exchange Unit correctly at the left stop (with virtually no play and without sticking).

- Set potentiometer '**dV/dt**' to left stop.
- Press **<DOS>** (on instrument) at same time and use a stopwatch to measure the time for 1/10 of the cylinder volume to be expelled. The time should be ca. 90 ... 110 s.
- Set potentiometer '**dV/dt**' to right stop.
- Press **<FILL>.**

11 Setting up original arrangement

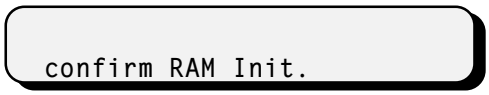
Reconnect all peripherals disconnected at the start of the diagnostic routine and perform a short function test with these.

4.3 Initialise and test RAM

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

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

- Press **<START>**.



- Press **<START>**.

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

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

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

4.4 Releasing a locked spindle with inserted Exchange Unit

- The burette drive may very occasionally jam at the top or bottom end of the cylinder. If jamming occurs at the top or when the drive is out of function, the Exchange Unit can no longer removed. In this case, it is necessary to proceed as follows:

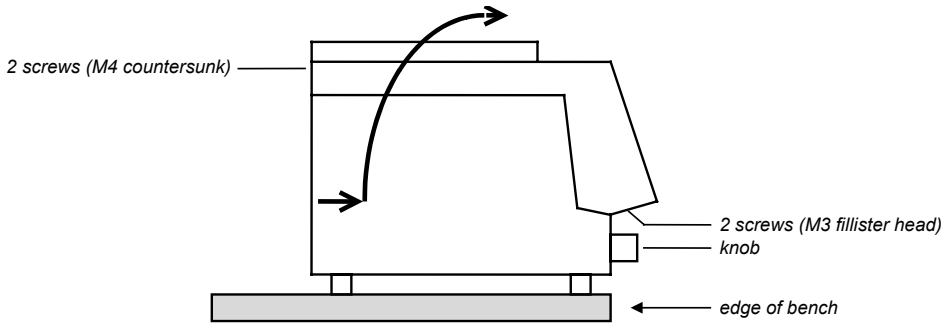


Fig. 7

- Disconnect instrument from power supply!
- Remove control knob
- Place instrument over edge of bench to allow the M3 screws to be removed (Fig. 7)
- Remove M4 screws
- Lift off top part of instrument together with Exchange Unit in the manner shown by the arrow

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

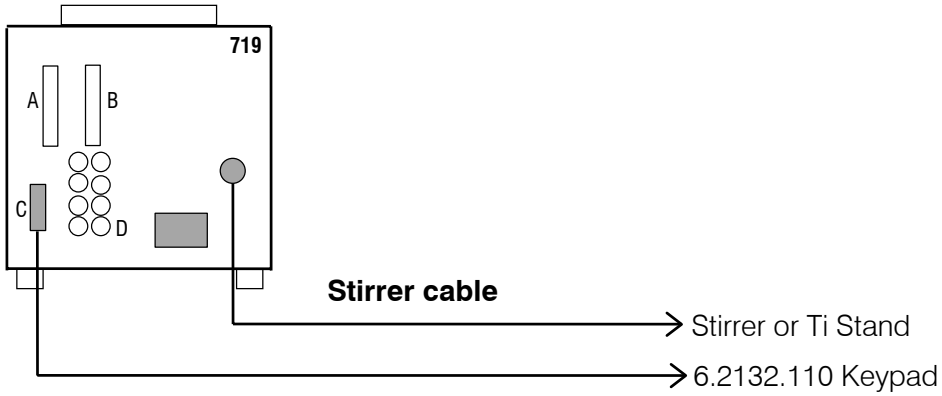
- Remove spindle from mechanical stop by turning the large gear wheel. (In case that the motor is inoperative, position spindle by hand to zero position.)

5 Preparations

The mains cables supplied with the instrument are three-core and equipped with a plug with an earthing pin. If a different plug has to be fitted, the yellow/green lead must be connected to the protective earth. Each break in the earthing inside or outside the instrument can make it a hazard.
When the instrument is opened or if parts of it are removed, certain components may be live if the instrument is connected to the mains. The mains cable must therefore always be unplugged when certain adjustments are made or parts replaced.

5.1 Setting up and connecting the instruments

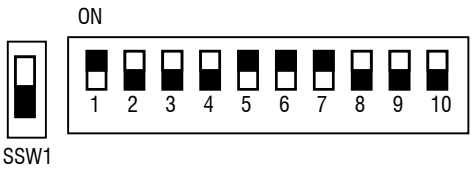
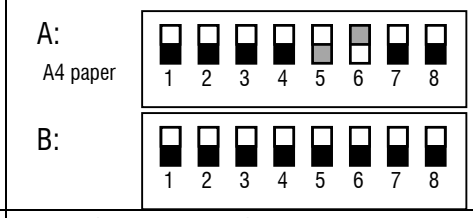
5.1.1 Titrino with Stirrer or Titration Stand



The 802 Rod Stirrer, the 727, or the 703 Ti Stand with 6.2108.100 cable can also be connected instead of the 728 Magnetic Stirrer.

5.1.2 Connection of a printer

A variety of printers can be connected to the RS232 interface of the Titrino. If you connect a printer other than one of those mentioned below, ensure that the Epson mode is emulated or that it uses the international character set following the IBM Standard Table 437 and IBM-compatible graphics control characters.
If a **balance** is connected at the same COM of the Titrino as a printer, you need the 6.2125.030 Adapter. The printer must be pluged into the "data out" receptable of the adapter. It can be operated only with the simple hardware handshake (HWs) or without handshake.

Printer	Cable	Settings on Titrino		Settings on Printer
Seiko DPU-414	6.2125.130	baud rate: data bit: stop bit: parity: handshake: send to:	9600 8 1 none HWs Seiko	none
Custom DP40-S4N	6.2125.130	baud rate: data bit: stop bit: parity: handshake: send to:	9600 8 1 none HWs Citizen	none, pre-set on Metrohm version IDP-560 EMULATION FONT MAP =GERMANY PRINT=REVERSE LITTLE CR CODE=VOID CR AFTER B :FULL=VOID CR ON b. EMPTY=VALID BUFFER 1K BYTE BAUD RATE=9600 PROTOCOL=8,N,1 FLOW CONTROL CTS-RTS
Citizen iDP562 RS	6.2125.050	baud rate: data bit: stop bit: parity handshake: send to:	9600 8 1 none HWs Citizen	
Epson LX-300	6.2125.050	as above, but send to:	 Epson	see printer manual
HP Desk Jet with serial interface	6.2125.050	baud rate: data bit: stop bit: parity handshake: send to:	9600 8 1 none HWs HP	
HP Desk Jet with parallel interface	2.145.0330 RS232/ Parallel Converter	baud rate: data bit: stop bit: parity handshake: send to:	9600 8 1 none HWs HP	see printer manual

5.1.3 Connection of a balance

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

Balance	Cable
Sartorius MP8, MC1	6.2125.070
Shimadzu BX, BW	6.2125.080 Settings on Titrino: balance SARTORIUS Balance: delimiter CR+LF
Ohaus Voyager, Explorer, Analytical Plus	from Ohaus: AS017-09 (Ohaus parts number)+ 6.2125.170 Settings on Titrino: balance SARTORIUS Balance: SET BALANCE INTERFACE BAUD RATE 9600 DATA BITS 8 PARITY none STOP BITS 1
Mettler AB, AG (LC-RS25)	in the scope of delivery of the balance
Mettler AM, PM	6.2146.020 additionally from Mettler: ME 47473 Adapter and ME 42500 hand switch or ME 46278 foot switch
Mettler interface 016	Cable in scope of delivery of interface 016: red lead to pin 3, white lead to pin 7 of the 25-pin connector 25-pole/9-pole adapter
Mettler interface 011 or 012	6.2125.020
Mettler AT	6.2146.020
Mettler PG, AB-S	6.2134.120 + 6.2125.170
Mettler AX, MX ,UMX	6.2134.120 + 6.2125.170
AND Models ER-60, 120, 180, 182 Models FR-200, 300 Models FX-200, 300, 320 with RS232 interface (OP-03)	6.2125.020
Precisa, balances with RS232C-interface	6.2125.080

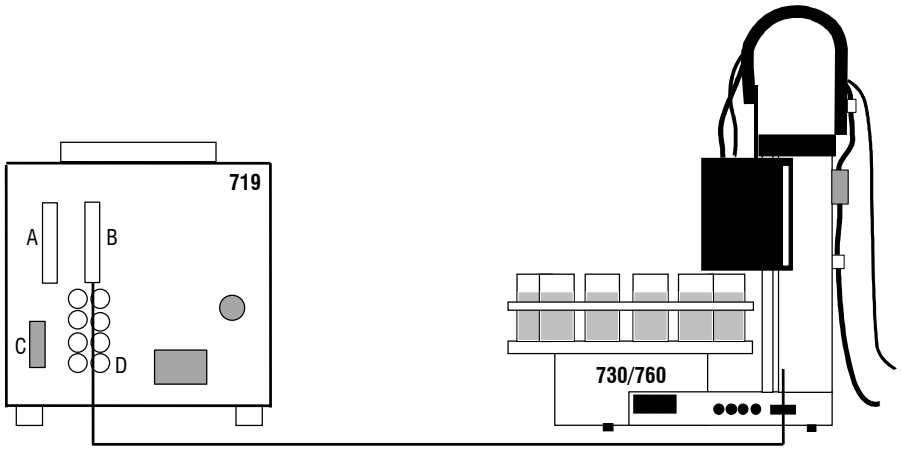
The balance type must be preselected at the Titrino with the <CONFIG> key.
Balance **and** printer can be connected at the same time with the aid of the 6.2125.030 adapter. The balance must then be plugged into the "data in" receptable of the adapter.

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	Id1	Id2	Id3
Sartorius	METH or 27	ID.1 or 26	ID.2 or 24	C-20 or 23
Mettler (AT)	D (Mthd)	C (ID#1)	B (ID#2)	A (c20)

If the balance works only with 7 bit and the printer with 8 bit and if they are at the same Titrino, the balance has to bet to "space parity" and Titrino/printer to 8 bit, "no parity".

5.1.4 Connection of a Sample Changer



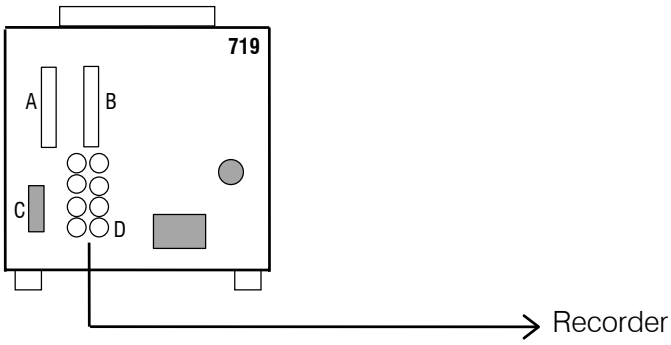
6.2141.020 Cable

With 6.2141.030 cable (instead of 6.2141.020), two Titrinos can be connected to the 730 or 760 Sample Changer at the same time.

- The "Remote" socket allows not only connection of a sample changer but also additional control functions. Pin assignment of the "Remote" socket and control possibilities, see page 129f.
- If a calibration has to be performed with the sample changer, the calibration parameter "sample changer:" must be set to "ON".
- In connections with the sample changer, "auto start" should be set to "OFF" in the <CONFIG> key. The start command is given by the Sample Changer.

5.1.5 Connection of a recorder

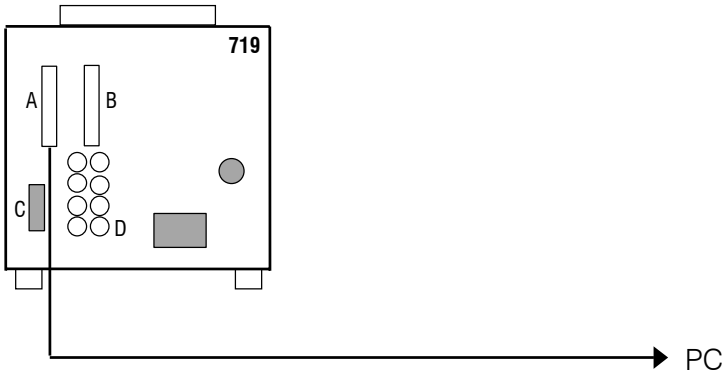
The recorder is connected to the analog output of the Titrino.



The signal at the analogue output can be preselected on the Titrino (key <CONFIG>, ">peripheral units", "curve:"):

Preselection at Titrino	Meaning	Resolution, Signal at analogue output	
U	Voltage	pH = 0.00:	– 700mV
		pH = 7.00:	0 mV
		pH = 14.00:	+700 mV
		U = + 1 mV:	+ 1 mV
		U = – 1 mV:	– 1 mV
		I = + 1 µA:	+ 10 mV
		I = – 1 µA:	– 10 mV
		T = 0 °C:	0 mV
		T = + 1 °C:	+ 10 mV
		T = – 1 °C:	– 10 mV
dU/dt	Measured value drift	1 mV/min:	1 mV
		1 °C/min:	1 mV
		1 µA/min:	10 mV
V	Volume	1 Zylindervolumen:	2000 mV
dV/dt	Volume drift	100 µL/min:	1000 mV
U(rel)	Control deviation	ΔpH = 1:	100 mV
		ΔU = 1 mV:	1 mV
		ΔI = 1 µA:	10 mV
T	Temperature	ΔT = ±1 °C:	10 mV
		T = 0 °C:	0 mV

5.1.6 Connection of a computer



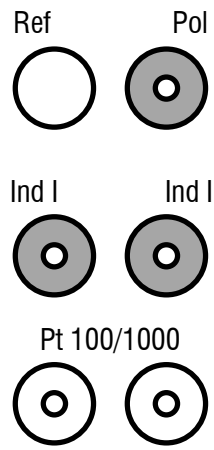
Cable 6.2125.060 (+6.2125.010)

Preselections on the Titrino:

RS232 settings: ..... depend on the control program of the computer
Send to: .....IBM
Vesuv 3.0, PC program for data acquisition and method backup
for up to 64 devices..... 6.6008.200

5.2 Connection of electrodes, preparing titration vessel

Rear panel:



Ref	Connection for separate reference electrode. Input is free when a combined electrode is used.
Pol	Connection of polarized electrodes. If measured quantities Ipol or Upol are selected, this measuring input is automatically active.
Ind I Ind II	Connection of pH, redox, ISE electrodes. Combined or separate electrodes. Select measuring input 1 or 2 in the Titrino. Important: The measuring inputs 1 and 2 have a common reference. They may therefore be used as a differential measuring input see below. However, only one reference electrode can be used in the same vessel!
Pt100/ 1000	Connection of a temperature sensor Pt100 or Pt1000..

Differential potentiometry

In potentiometric measurements in media of low conductivity, e.g. in organic solvents, high-impedance electrode assemblies such as pH electrodes record noise voltages which arise from stray electrostatic and electromagnetic fields. Particularly high field strengths occur through friction at insulators such as plastic floors, synthetic clothing, etc.; conditions which can appear in every normal laboratory environment.

Problems of this type can be solved by measurement using a differential amplifier. Here, the indicator and reference electrode are each connected to a high-impedance measuring input. It is important to ensure that both electrodes have identical shielding and are thus symmetrical with regard to the recording of noise signals. An auxiliary electrode provides the electrical connection between the reference point of the amplifier circuit and the measurement solution. Recommended electrodes:

Meas.input	Manual determinations	Sample Changers
Ind I	6.0133.100 pH Glass electrode	6.0130.100 pH Glass electrode
Ind II	6.0729.100 double-shielded Ag/AgCl reference electrode	6.0729.110 double-shielded Ag/AgCl reference electrode
Ref	6.0301.100 auxiliary electrode	6.0302.110 auxiliary electrode

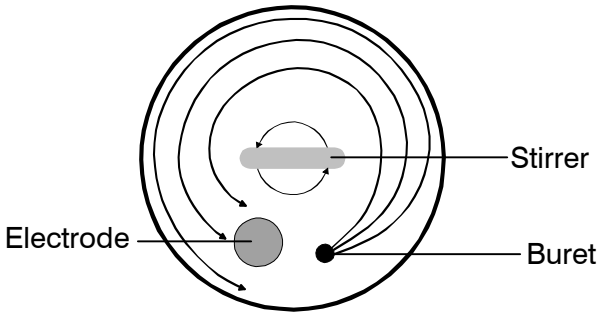
Practical tips

- Glass electrodes should be preconditioned in the solvent used for ca. 1 hour.
- If the potential jump after the first dispensing step is too large, a small start volume may help.
- As an "auxiliary electrode", the 6.1808.030 burette tip with earthing may be used in some cases. Use burette tips without anti-diffusion valve!

Setting up the titration vessel

The titration vessel is set up as shown below. During a titration, it is important to ensure that the solution in contact with the electrode is thoroughly mixed. This is achieved by

- efficient stirring. But it should not be too fast, otherwise the stirrer vortex will suck in air bubbles and CO_2 or O_2 can disturb the titration.
- placing the buret tip according to the drawing below for maximum distance between the adding of the titrant and the electrode.



Pay attention on the direction of rotation of the stirrer!

6 Appendix

6.1 Technical specifications

Modes
SET: **S**et **E**nd point **T**itration
MEAS: **Meas**urement
CAL: pH **cal**ibration

Measuring inputs
2 high-impedance measuring inputs for pH, redox and ISE electrodes.
1 reference input for a separate reference electrode. May also be used as a differential amplifier.
1 measuring input for polarized electrodes.
1 measuring input for temperature sensor Pt100 or Pt1000.

Measuring range

pH value (pX)	0...±20.00, resolution 0.01
Voltage	0...±2000 mV, resolution 1 mV, error limit 0.1 % fullscale
Current	0...±200 μA, resolution 1 μA
Temperature	–150.0...+450.0 °C, resolution 1 °C

Polarizer

Ipol	0...±127 μA, resolution 1 μA
Upol	0...±1270 mV, in steps of 10 mV

Measuring amplifier (at 25 °C and Titrino warmed-up)

Input resistance	$>10^{13}\,\Omega$
Offset current	$<3*10^{-13}$ A
Deviation of offset voltage	15 μV/K

Dosification

Volume of buret cylinder	1, (2), 5, 10, 20 or 50 mL
Resolution	10 000 steps per buret cylinder
Titrating burets	1 internal buret
Auxiliary burets	2 additional burets: 776 or 765 Dosimat

Materials

Housing	Polybutyleneterephthalate (PBTP)
Keypad cover	Polycarbonate (PC)

Display
LCD, 2 lines of 24 characters each
Height of characters 5 mm
LED back-lit

Internal memory
Method memory for up to 100 methods.
Data bank with 4 Metrohm methods.
Silo memory for sample data and results

RS232 interface for printer, balance or computer connection: completely controllable from external control unit

Remote input/output lines for Sample Changer, robot connection, etc.

Analog output

Output signal	-2000 ... 2000 mV
Signal at analog-output	depending on preselection: U (measuring value) dU/dt (measured value drift) V (volume) dV/dt (volume drift) U(rel) (control deviation at SET) T (temperature) 1 mV (12 Bit), see also page 122

Ambient temperature

Nom. operation range	5 ... 40 °C
Storage	– 20 ... 60 °C
Transport	– 40 ... 60 °C

Safety specifications Designed and tested in accordance to IEC publication 61010-1, safety class I. This manual contains information and warnings which have to be followed by the user to ensure safe operation and to retain the apparatus in safe condition.

Mains connection

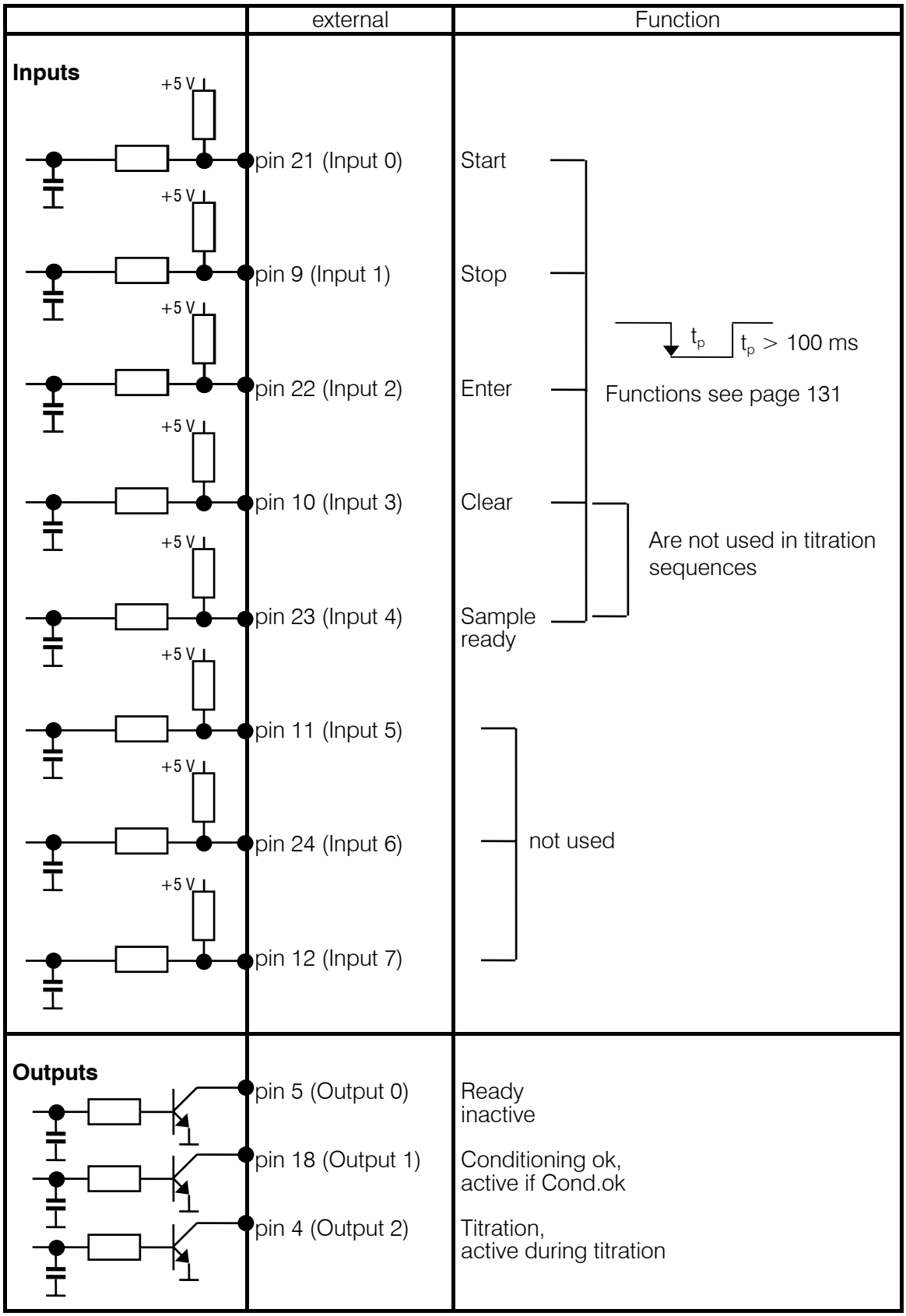
Voltage	100, 117, 220/230, 240 V (switchable)
Frequency	50 ... 60 Hz
Power consumption	15 W
Fuse	Thermal fuse

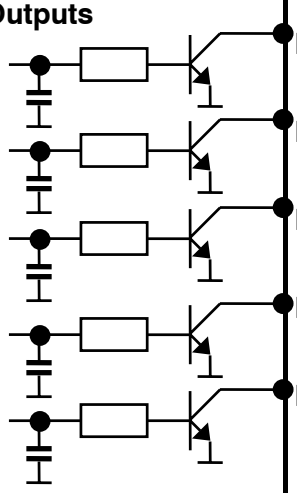
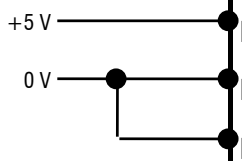
Dimensions with Exchange Unit

Width	150 mm
Height	450 mm
Depth	275 mm

Weight, incl. keypad app. 3.6 kg

6.2 Pin assignment of the "Remote" socket

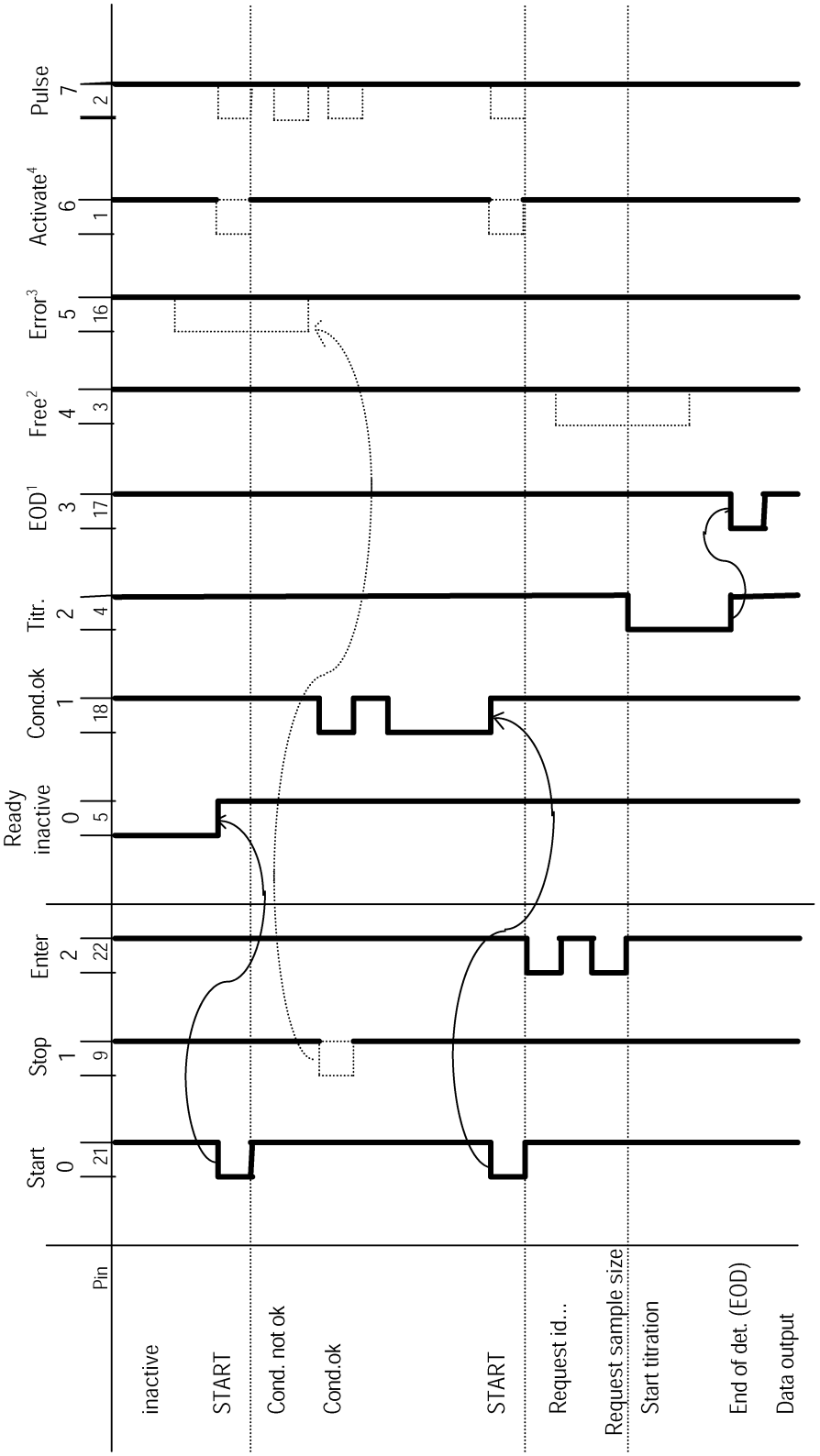


Outputs 	pin 17 (Output 3)	End of determination EOD
	pin 3 (Output 4)	To be set via RS232 control
	pin 16 (Output 5)	Error, active with errors
	pin 1 (Output 6)	Activate pulse, see page 131.
	pin 2 (Output 7)	Pulses for recorder (t_p=150 µs) 10 000 per buret cylinder
		For all outputs: V_{CE0} = 40 V I_C = 20 mA t_{Pulse} > 100 ms Functions see page 131.
Voltage 	pin 15	I ≤ 75 mA
	pin 14	0 V: active 5 V: inactive
	pin 25	

Ordering numbers for plug:
K.210.9004 (shell) and K.210.002

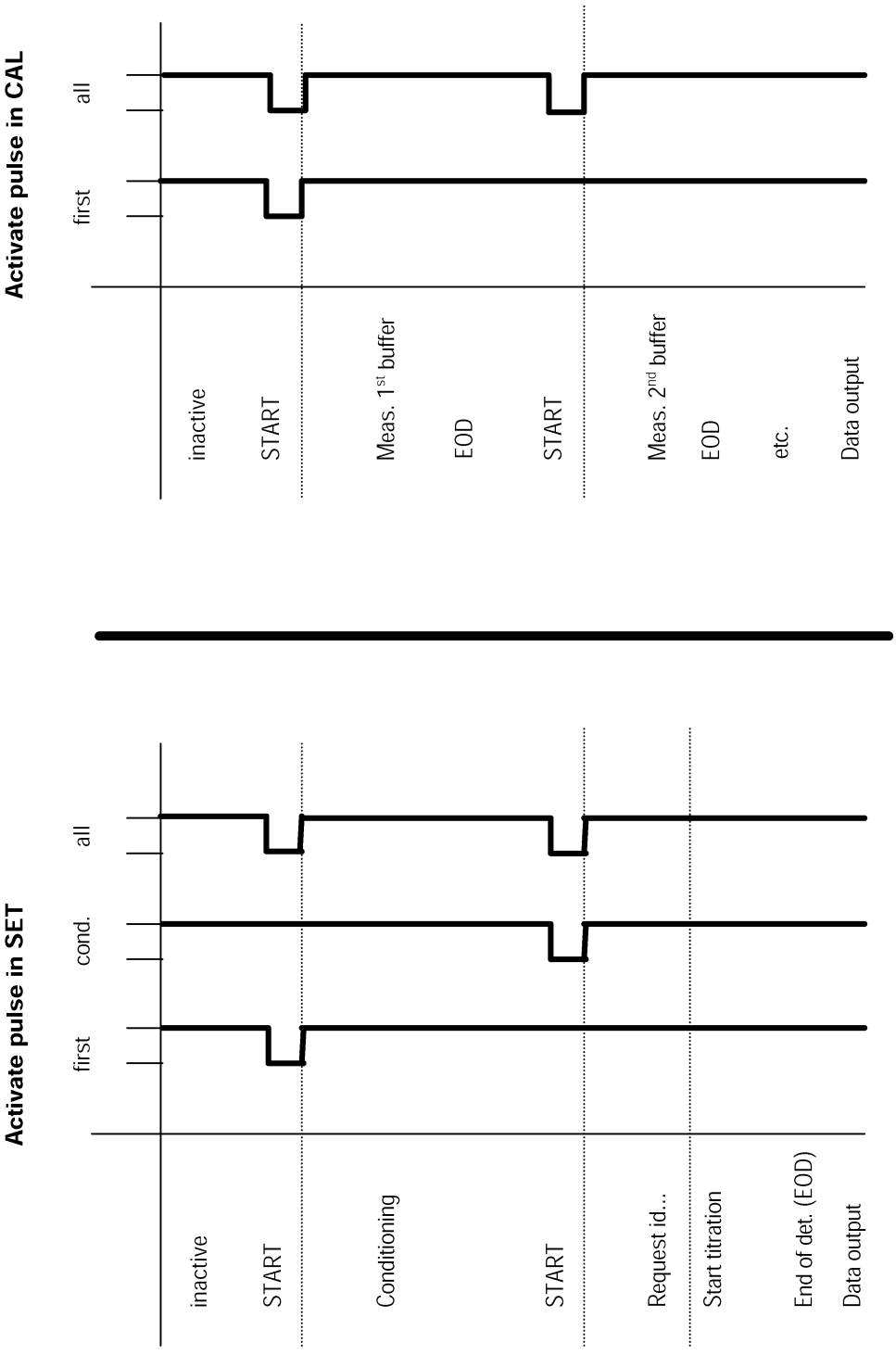
No liability whatsoever will be accepted for damage caused by improper interconnection of instruments.

6.2.1 Lines of the "Remote" socket during the titration



1: In CAL, EOD is sent after every buffer. Automatic output of EOD can be switched off via RS232, see page 90.
2: Line can be set via RS232, see page 90.
3: The error line is reset when the error is rectified.
4: According to method configuration, see pages 29, 35 and 37.

6.2.2 Possible configurations of the activate pulse in SET and CAL



6.3 User methods

6.3.1 General

The methods are stored in the user memory ready for use. They can be loaded, modified and overwritten.

If the result should have another unit, you need to adjust the calculation constants using the key <C-FMLA>.

Stop volumes or other stop conditions should be entered depending on sample.

If a printer is connected, the methods should be completed with report instructions (key <DEF>).

The following methods are available:

```
 'um
719 S Titrino           18200   719.0021
date  2002-03-13    time  12:22
user method                     bytes
SET  pH        p+m_Val            240
SET  pH        Tit.HCl            178
SET  pH       Tit.NaOH            178
SET  Ipol      Br_No.             172
       remaining bytes           9206
          ------------
```

6.3.2 "Tit.HCl"

```
 'pa
719 S Titrino           18200   719.0021
date  2002-03-13    time  12:24        0
SET  pH             Tit.HCl
parameters
>SET1
  EP at pH              5.10
  dynamics                 3
  max.rate                 5 ml/min
  min.rate               0.5 µl/min
  stop crit:           drift
  stop drift              20 µl/min
>SET2
  EP at pH               OFF
>titration parameters
  titr.direction:       auto
  pause 1                  0 s
  start V:              rel.
  factor                  70
  dos.rate              max. ml/min
  pause 2                  5 s
  extr.time                0 s
  meas.input:              1
  temperature           25.0 °C
>stop conditions
  stop V:               abs.
  stop V               99.99 ml
  filling rate          max. ml/min
>statistics
  status:                 ON
  mean               n=    5
  res.tab:           original
>preselections
  conditioning:          OFF
  req.ident:             OFF
  req.smpl size:       value
  activate pulse:        OFF
         ------------

 'fm
719 S Titrino           18200   719.0021
date  2002-03-13    time  12:24        0
SET  pH             Tit.HCl
>calculations
Titer=C00*C01/C02/EP1;4;
C00=                 1.0
C01=               10000
C02=              121.14
         ------------

 'de
719 S Titrino           18200   719.0021
date  2002-03-13    time  12:24
SET  pH             Tit.HCl
def
>formula
  Titer=C00*C01/C02/EP1
  RS1 text              Titer
  RS1 decimal places        4
  RS1 unit:
>common variables
  C36=MN1
>report
>mean
  MN1=RS1
         ------------
```

Titer determination of HCl using TRIS.

The titer is calculated as a factor without dimension out of 5 determinations and stored as common variable C36. It can therefore be used directly by subsequent methods.

Electrode:
6.0232.100 combined glass pH electrode, at measuring input 1.

Titrant:
c(HCl) = 0.1 mol/L

Sample:
Weigh in Tris(hydroxymethyl)aminomethane (TRIS) dried 2 h at 105 °C.
Sample size according to the buret volume.
Dilute in 40 mL dist. water.

Reference:
METROHM Application Bulletin Nr. 206:

– Result (Titer) as a digit without dimension
– Sample size TRIS in g
– Theoretical consumption for 1 mol TRIS
– Molar mass of TRIS

C36 is the common variable for the titer
c(HCl) = 0.1 mol/L

6.3.3 "Tit.NaOH"

```
 'pa
719 S Titrino           18200   719.0021
date  2002-03-13    time  12:44        0
SET  pH            Tit.NaOH
parameters
>SET1
  EP at pH              8.65
  dynamics                 3
  max.rate                 5 ml/min
  min.rate               0.5 µl/min
  stop crit:           drift
  stop drift              20 µl/min
>SET2
  EP at pH               OFF
>titration parameters
  titr.direction:       auto
  pause 1                  0 s
  start V:              rel.
  factor                  35
  dos.rate              max. ml/min
  pause 2                  5 s
  extr.time                0 s
  meas.input:              1
  temperature           25.0 °C
>stop conditions
  stop V:               abs.
  stop V               99.99 ml
  filling rate          max. ml/min
>statistics
  status:                 ON
  mean               n=     5
  res.tab:           original
>preselections
  conditioning:          OFF
  req.ident:             OFF
  req.smpl size:       value
  activate pulse:        OFF
         ------------

 'fm
719 S Titrino           18200   719.0021
date  2002-03-13    time  12:44        0
SET  pH            Tit.NaOH
>calculations
Titer=COO*CO1/CO2/EP1;4;
COO=                  1.0
CO1=                10000
CO2=               204.23
         ------------

 'de
719 S Titrino           18200   719.0021
date  2002-03-13    time  12:44
SET  pH            Tit.NaOH
def
>formula
  Titer=COO*CO1/CO2/EP1
  RS1 text             Titer
  RS1 decimal places       4
  RS1 unit:
>common variables
  C37=MN1
>report
>mean
  MN1=RS1
         ------------
```

Titer determination of NaOH using PHP.

The titer is calculated as a factor without dimension out of 5 determinations and stored as common variable C37. It can therefore be used directly by subsequent methods.

Electrode:
6.0232.100 combined glass pH electrode, at measuring input 1.

Titrant:
c(NaOH) = 0.1 mol/L (free of carbonate)

Sample:
Weigh in potassium hydrogen phtalate (PHP), dried 2 h at 105 °C.
Sample size according to the buret volume.
Dilute in 40 mL dist. Water (free of carbonate).

Reference:
METROHM Application Bulletin Nr. 206:

– Result (Titer) as a digit without dimension
– Sample size of PHP in g
– Theoretical consumption for 1 mol PHP
– Molar mass PHP

C37 is the common variable for the titer *c*(NaOH) = 0.1 mol/L.

6.3.4 "p+m_Val"

```
 'pa
719 S Titrino           18200   719.0021
date  2002-03-13    time  12:49        0
SET  pH             p+m_Val
parameters
>SET1
  EP at pH               8.20
  dynamics                  2
  max.rate                  5 ml/min
  min.rate                  5 µl/min
  stop crit:           drift
  stop drift               20 µl/min
>SET2
  EP at pH               4.30
  dynamics                  3
  max.rate                  5 ml/min
  min.rate                  5 µl/min
  stop crit:           drift
  stop drift               20 µl/min
>titration parameters
  titr.direction:        auto
  pause 1                   0 s
  start V:                OFF
  pause 2                   0 s
  extr.time                 0 s
  meas.input:               1
  temperature            25.0 °C
>stop conditions
  stop V:                abs.
  stop V                99.99 ml
  filling rate           max. ml/min
>statistics
  status:                   ON
  mean                n=     3
  res.tab:            original
>preselections
  conditioning:            OFF
  req.ident:               OFF
  req.smpl size:           OFF
  activate pulse:          OFF
          ------------
 'fm
719 S Titrino           18200   719.0021
date  2002-03-13    time  12:49        0
SET  pH             p+m_Val
>calculations
p value=(EP1*C36*C01-C02)*C03;2;
m value=(EP2*C36*C01-C02)*C03;2;
C01=                 1.00
C02=                  1.0
C03=                    4
C36=                  0.0
          ------------
 'de
719 S Titrino           18200   719.0021
date  2002-03-13    time  12:49
SET  pH             p+m_Val
def
>formula
  p value=(EP1*C36*C01-C02)*C03
  RS1 text             p value
  RS1 decimal places         2
  RS1 unit:
  m value=(EP2*C36*C01-C02)*C03
  RS2 text             m value
  RS2 decimal places         2
  RS2 unit:
>common variables
>report
>mean
  MN1=RS1
  MN2=RS2
          ------------
```

Determination of the acid capacity, resp. $pK_{A\ 8.2}$ and $pK_{A\ 4.3}$ of water and waste water.

The p-value represents the amount of acid to be added to reach the pH value 8.2 (color change of phenolphthalein).

The m-value represents the amount of acid to be added to reach the pH value 4.3 (color change of methyl orange).

Electrode:
Combined pH-glass electrode 6.0232.100 at measuring input 1.

Titrant:
c(HCl) = 0.1 mol/L

Sample:
25 mL water

Reference:
DIN 38 409, part 7 (1979)

Remarks:
When working without carbonate addition, set the calculation variable C02 to 0 (key <C-FMLA>).

C03 has to be 1 for sample size 100 mL (instead of 25 mL).

This method can easily be modified to match the particular specifications of each country, e.g. the specified pH value may vary slightly.

– Results in mmol/L

– Concentration of titrant * 10
– Amount of carbonate addition in mmol
– Factor for 100 mL sample
– Titer c(HCl) = 0.1 mol/L

6.3.5 "Br_No"

```
 'pa
719 S Titrino           18200   719.0021
date  2002-03-13    time  13:05        0
SET  Ipol            Br_No.
parameters
>SET1
  EP at U                 500 mV
  dynamics                500 mV
  max.rate               10.0 ml/min
  min.rate               25.0 µl/min
  stop crit:            drift
  stop drift               20 µl/min
>SET2
  EP at U                 OFF mV
>titration parameters
  titr.direction:           -
  pause 1                   0 s
  start V:                OFF
  pause 2                   0 s
  extr.time                 0 s
  I(pol)                   10 µA
  electrode test:         OFF
  temperature            25.0 °C
>stop conditions
  stop V:                 abs.
  stop V                 99.99 ml
  filling rate            max. ml/min
>statistics
  status:                   ON
  mean                n=     3
  res.tab:            original
>preselections
  conditioning:           OFF
  req.ident:              OFF
  req.smpl size:        value
  activate pulse:         OFF
          ------------

 'fm
719 S Titrino           18200   719.0021
date  2002-03-13    time  13:05        0
SET  Ipol            Br_No.
>calculations
Br_No.=(EP1-C01)*C02*C03*C04/C00;0;
C00=                  1.0
C01=                    0
C02=                  0.5
C03=                 7.99
C04=                  100
          ------------

 'de
719 S Titrino           18200   719.0021
date  2002-03-13    time  13:06
SET  Ipol            Br_No.
def
>formula
  Br_No.=(EP1-C01)*C02*C03*C04/C00
  RS1 text              Br_No.
  RS1 decimal places         0
  RS1 unit:
>common variables
>report
>mean
  MN1=RS1
          ------------
```

Determination of the bromine number in petroleum hydrocarbons according to ASTM D 2710-72, resp. ISO 3839:1996.

The bromine number is defined as the quantity of bromine in mg which reacts with 100g sample.

Electrode:
6.0308.100 double Pt-electrode, at measuring input "Pol".

Titrant:
Solution of bromide/bromate,
$c(BrO_3^-/Br^-) = 0.05$ mol/L.
Dilute 5.1 g KBr and 1.4 g $KBrO_3$ separately in water and make up to 1 L.

Solvent:
714 mL glacial acetic acid,
134 mL 1,1,1-trochloroethane,
134 mL Methanol,
18 mL $w(H_2SO_4) = 0.2$ (20%)

Sample:
Dissolve the appropriate amount of sample (depending on the expected bromine number) in 20 – 100 mL solvent. Titrate blank sample the same way.

Reference:
ASTM D1159-84
ISO 3839:1996
Metrohm Application Bulletin Nr. 177

– Result in mg bromine/100 g sample
– Sample size in g
– Consumption of blank sample in mL
– Normality of the titrant (0.05*titer)
– Molar mass of Br_2 * 0.05
– Dilution factor

6.4 Validation / GLP

GLP (Good Laboratory Practice) requires the periodic validation of the analytical instruments. The reproducibility and accuracy of the instruments are checked according to standard operating procedures.

Guidelines for the testing regulations (SOP, Standard Operating Procedure) are given in the following Metrohm Application Bulletin:
No. 252: Validation of Metrohm Titrators (potentiometric) according to GLP/ISO 9001.

Contact your Metrohm agency for support with the validation of your Titrino. There you get a validation documentation, which helps you to perform the installation qualification (IQ) and the operational qualification (OQ).

6.5 Warranty and conformity

6.5.1 Warranty

The warranty regarding our products is limited to rectification free of charge in our workshops of defects that can be proved to be due to material, design or manufacturing faults which appear within 12 months from the day of delivery. Transport costs are chargeable to the purchaser.

For day and night operation, the warranty is valid for 6 months.

Glass breakage in the case of electrodes or other glass parts is not covered by the warranty. Checks which are not a result of material or manufacturing faults are also charged during the warranty period. For parts of outside manufacture insofar as these constitute an appreciable part of our instrument, the warranty stipulations of the manufacturer in question apply.

With regard to the guarantee of accuracy, the technical specifications in the Instructions for Use are authoritative.

Concerning defects in material, construction or design as well as the absence of guaranteed features, the purchaser has no rights or claims except those mentioned above.

If damage of the packaging is evident on receipt of a consignment or if the goods show signs of transport damage after unpacking, the carrier must be informed immediately and a written damage report demanded. Lack of an official damage report releases METROHM from any liability to pay compensation.

If any instruments and parts have to be returned, the original packaging should be used if at all possible. This applies above all to instruments, electrodes, buret cylinders and PTFE pistons. Before embedment in wood shavings or similar material, the parts must be packed in a dustproof package (for instruments, use of a plastic bag is imperative). If open assemblies are enclosed in the scope of delivery that are sensitive to electromagnetic voltages (e.g. data interfaces etc.) these must be returned in the associated original protective packaging (e.g. conductive protective bag). (Exception: assemblies with built-in voltage source belong in a non-conductive protective packaging). For damage which arises as a result of non-compliance with these instructions, no warranty responsibility whatsoever will be accepted by METROHM.

6.5.2 EU Declaration of conformity

CE

EU Declaration of Conformity

The METROHM AG company, Herisau, Switzerland hereby certifies, that the instrument:

719 S Titrino

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

Source of the specifications:

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

Description of apparatus:

Titrator for fast and precise end point titrations, titration sequences can be programmed and methods stored in the internal memory.

Herisau, October 30, 2001

Dr. J. Frank	Ch. Buchmann
Leiter Entwicklung	Leiter Produktion und Beauftragter Qualitätssicherung

6.5.3 Certificate of Conformity and System Validation

Certificate of Conformity and System Validation

This is to certify the conformity to the standard specifications for electrical appliances and accessories, as well as to the standard specifications for security and to system validation issued by the manufacturing company.

Name of commodity:	719 S Titrino
System software:	Stored in ROMs
Name of manufacturer:	Metrohm Ltd., Herisau, Switzerland

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

Electromagnetic compatibility: Emission
EN50081-1, EN50081-2, EN55022 (class B)

Electromagnetic compatibility: Immunity
EN50082-1, IEC61000-6-2, Namur, IEC61000-4-2, IEC61000-4-3, IEC61000-4-5, IEC61000-4-6, IEC61000-4-11

Safety specifications
IEC61010-1, EN61010-1

It has also been certified by the Swiss Electrotechnical Association (SEV), which is member of the International Certification Body (CB/IEC).

The technical specifications are documented in the instruction manual.

The system software, stored in Read Only Memories (ROMs) has been validated in connection with standard operating procedures in respect to functionality and performance. The features of the system software are documented in the instruction manual.

Metrohm Ltd. is holder of the SQS-certificate of the quality system ISO 9001 for quality assurance in design/development, production, installation and servicing.

Herisau, October 30, 2001

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

6.6 Scope of delivery and ordering designations

719 S Titrino 2.719.0020
inclusive the following accessories:

1 Titrino..... 1.719.0020
1 Keypad for 719 S Titrino..... 6.2132.110
1 Key for Exchange Units..... 6.2739.010
1 Mains cable with cable socket, type CEE(22), V
Cable plug to customer's specifications
type SEV 12 (Switzerland...) 6.2122.020
type CEE(7), VII (Germany...) 6.2122.040
type NEMA/ASA (USA...) 6.2122.070
1 Vesuv 3.0 light, PC program for data acquisition and method backup
for 2 devices..... 6.6008.500
1 Instructions for Use for 719 S Titrino 8.719.1103
1 Quick Reference for 719 S Titrino 8.719.1113

Options

Accessories to separate order and on payment of extra charge:

Burets

Auxiliary burets
765 Dosimat 2.765.0010
776 Dosimat 2.776.0010
Cable Titrino (activate pulse, line L6) — 765 or 776 Dosimat..... 6.2139.000
Exchange Units
V = 1 mL, ... 6.3026.110
V = 5 mL, ... 6.3026.150
V = 10 mL, ... 6.3026.210
V = 20 mL, ... 6.3026.220
V = 50 mL, ... 6.3026.250

Stirrers and Titrating Stands

728 Magnetic stirrer..... 2.728.0040
727 Ti Stand for rinsing and addition of fresh solvent..... 2.727.0010
802 Rod Stirrer 2.802.0010
727 Ti Stand with built-in magnetic stirrer 2.727.0100

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

Titration vessel with thermostatic jacket, 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 lid (5 openings) 6.1414.010

Magnetic stirring bars, length
- 12 mm 6.1903.010
- 16 mm 6.1903.020
- 25 mm 6.1903.030

Electrode holder 6.2021.020

Equipement for KF titrations 6.5609.000

Electrodes and accessories

comb. pH Glass electrode with SGJ, without cable 6.0233.100

comb. pH glass electrode, without cable 6.0232.100

comb. pH micro glass electrode, without cable 6.0234.100

comb. pH glass electrode with built-in T sensor, with SGJ 6.0238.000

T adapter for the connection of one electrode to 2 Titrinos 6.2103.100

T sensor (Pt1000) with SGJ, without cable 6.1110.100

Electrode cable, 1m 6.2104.020

Cable for T sensor 6.2104.080

SGJ sleeve for electrodes without SGJ 6.1236.040

Printers

Custom-Drucker DP40-S4N 2.140.0200

Cable Titrino – Custom DP40-S4N (25/9 pins) 6.2125.130

Cable Titrino – Seiko DPU-414 ..... 6.2125.130

Cable Titrino – EPSON LX300+ (25/25 pins) 6.2125.050

Cable Titrino – HP Desk Jet (serial interface) (25/25 pins) 6.2125.050

Cable Titrino – HP Desk/Laser Jet (parallel IF) 2.145.0330

Adapter for connection of printer/balance at the same COM 6.2125.030

Balances

Cable Sartorius – balances MP8, MC1 (9/25 pins) 6.2125.070
Cable Shimadzu – balances BX, BW 6.2125.080
Ohaus Voyager, Explorer, Analytical Plus ..... cable from Ohaus
Mettler AB, AG balances (interface LC-RS25) ..... cable with balance
Mettler AT balance 6.2146.020
Mettler AM, PM balance .....6.2146.020+accessories from Mettler
Mettler balances with interface 016..... cable from Mettler
Mettler balances with interface 011 or 012 ..... 6.2125.020
Mettler PG, AB-S, AX, MX, UMX balances ..... 6.2134.120+6.2125.170
AND balances (with RS232 interface OP-03)..... 6.2125.020
Precisa balances..... 6.2125.080
Adapter for connection of printer/balance at the same COM..... 6.2125.030

PC connection

Cable Titrino – PC (25/25 pins) 6.2125.060
Cable Titrino – PC (25/9 pins) ..... 6.2125.060+6.2125.010
RS232 C extension cable (25/25 pins)..... 6.2125.020
Vesuv 3.0, PC program for data acquisition and method backup
for up to 64 devices 6.6008.200

Sample Changer

730 Sample Changer, 1 working station, 1 pump and 1 valve 2.730.0010
730 Sample Changer, 1 working station, 2 pumps and 2 valves 2.730.0020
730 Sample Changer, 2 working stations, 2 pumps and 2 valves..... 2.730.0110
730 Sample Changer, 2 working stations, 4 pumps and 4 valves..... 2.730.0120
760 Sample Changer, 1 working station..... 2.760.0010
Cable Titrino — 730, 760 Sample Changer 6.2141.020
Cable 2x Titrino — 730, 760 Sample Changer..... 6.2141.030
Cable Titrino — 730, 760 Sample Changer+665, 725, 765, 776 Dosimat 6.2141.040
Cable Titrino — 730, 760 Sample Changer+ 2x 665, 725, 765, 776 Dosimat ... 6.2141.050
Cable Titrino — Control Unit 664 for Sample Changer 673/674..... 3.980.3560

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