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OPERATING MANUAL

TitroLine® 5000

TITRATOR

SI Analytics

a xylem brand

Wichtige Hinweise:

Die Gebrauchsanleitung ist Bestandteil des Produktes. Vor der ersten Inbetriebnahme bitte sorgfältig lesen, beachten und anschließend aufbewahren. Aus Sicherheitsgründen darf das Produkt ausschließlich für die beschriebenen Zwecke eingesetzt werden. Bitte beachten Sie auch die Gebrauchsanleitungen für eventuell anzuschließende Geräte.

Alle in dieser Gebrauchsanleitung enthaltenen Angaben sind zum Zeitpunkt der Drucklegung gültige Daten. Es können jedoch vom Hersteller sowohl aus technischen und kaufmännischen Gründen, als auch aus der Notwendigkeit heraus, gesetzliche Bestimmungen verschiedener Länder zu berücksichtigen, Ergänzungen am Produkt vorgenommen werden, ohne dass die beschriebenen Eigenschaften beeinflusst werden. Eine möglicherweise aktuellere Version dieser Gebrauchsanleitung finden Sie auf unserer Webseite. Die deutsche Fassung ist die Originalversion und in allen technischen Daten bindend!

Important notes:

The operating manual is part of the product. Before initial operation, please carefully read and observe the operating manual and keep it. For safety reasons the product may only be used for the purposes described in these present operating manual. Please also consider the operating manuals for the devices to be connected.

All specifications in this operating manual are guidance values which are valid at the time of printing. However, for technical or commercial reasons or in the necessity to comply with the statuary stipulations of various countries, the manufacturer may perform additions to the product without changing the described properties. A potentially more recent version of this manual is available on our internet website. The German version is the original version and binding in all specifications!

Instructions importantes:

Le mode d'emploi fait partie du produit. Prière de lire et d'observer attentivement le mode d'emploi avant la première mise en marche de produit, et de le conserver. Pour des raisons de sécurité, le produit ne pourra être utilisé que pour les usages décrits dans ce présent mode d'emploi. Nous vous prions de respecter également les modes d'emploi pour les appareils à connecter.

Toutes les indications comprises dans ce mode d'emploi sont données à titre indicatif au moment de l'impression. Pour des raisons techniques et/ou commerciales ainsi qu'en raison des dispositions légales existantes dans les différents pays, le fabricant se réserve le droit d'effectuer des suppléments concernant le produit pour séries de dilution qui n'influencent pas les caractéristiques décrits. Une version éventuellement plus récente de ce mode d'emploi est disponible sur notre site Internet. La version allemande est la version originale et obligatoire quelles que soient les spécifications!

Instrucciones importantes:

El manual de instrucciones forma parte del producto. Antes de la operación inicial de producto, lea atentamente y observe la manual de instrucciones y guárdelas. Por razones de seguridad, el producto sólo debe ser empleado para los objetivos descritos en este manual de instrucciones. Por favor, observe la manual de instrucciones para los dispositivos a conectar.

Todas las especificaciones en este manual de instrucciones son datos orientativos que son válidos en el momento de la impresión. No obstante, por motivos técnicos o comerciales, o por la necesidad de respetar las normas legales existentes en los diferentes países, el fabricante puede efectuar modificaciones del producto sin cambiar las características descritas. Una versión más reciente de este manual se encuentra disponible en nuestra página de Internet. ¡La versión en alemán es la versión original y se establece en todas las especificaciones!

EG – KONFORMITÄTSERKLÄRUNG / EC – DECLARATION OF CONFORMITY
CE – DECLARATION DE CONFORMITE / CEE – DECLARATION DE CONFIRMIDAD

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1 Technical Specifications of the Titrator TitroLine® 5000

1.1 Notes to the operating manual

The provided operating manual will allow you the proper and safe handling of the product. For maximum security, observe the safety and warning instructions in the operating manual!

⚠ Warning of a general danger:
Non-compliance results (can result) in injury or material damage.
ℹ Important information for device use.
🕮 Refers to another part of the operating manual.

The menu screens shown in this operating manual serve as an example and may differ from what you see!

1.2 Intended Use

The TitroLine® 5000 is a potentiometric titrator and suitable for pH and mV titrations with a maximum of 5 memorisable methods.

The examples of possible use include:

- Acid and base determination in aqueous solutions such as p and m value, titration of strong and weak acids and bases
- Redox titrations such as iodometry, manganometry, chromatometry, and COD determinations, other mV titrations, e.g. chloride
- Titrations using ion-selective electrodes, e.g. coppe-ISE
- Indices such as iodine and peroxide value

These methods are mere examples; further applications can be found in food technology, environment, quality control, and process monitoring.

In addition, the TitroLine® 5000 comes with the functionalities of the TITRONIC® 300 piston burette:

- Manual titrations with or without calculation of the result
- Dosing

Each method allows for the setting of a variety of dosing and filling rates.

Solutions to be used:

Virtually, any liquids and solutions with a viscosity of < = 10 mm²/s such as concentrated sulphuric acid may be used.

⚠ However, one has to avoid the use of chemicals that may attack glass, PTFE or FEP or that are explosive, such as hydrofluoric acid, sodium azide or bromine! Suspensions containing high solids percentages may clog or even damage the dosing system.

⚠ **Do not use the device in hazardous locations!**

⚠ **General:**

The safety guidelines that are applicable to the handling of chemicals have to be observed under all circumstances. This applies in particular to inflammable and/or etching liquids.

1.3 Technical Specifications

1.3.1 Titrator TitroLine® 5000

Translation of the legally binding German version (Release: 18. June 2020)

EMC compatibility according to the Council Directive: 2014/30/EU;
applied harmonized standards: EN 61326-1: 2013
Low-voltage directive according to the Council Directive 2014/35/EU;
Testing basis EN 61 010-1: 2010 for laboratory equipment
RoHS Council Directive 2011/65/EU
FCC Part 15B and ICES 003

Country of origin: Germany, Made in Germany

The following solvents/titration reagents are allowed to be used:

- All common titration solutions.
- As reagent water and all non-aggressive non-organic and organic fluids are allowed.
- If using combustible fluids fire please adhere to the Guidelines for Explosion Protection and Prevention of the chemical industry.
- For fluids with higher viscosity (≥ 5 mm^2/s), lower boiling point or affinity to outgas, the filling and dosage speed can be adjusted.
- Fluids with viscosity over 20mm^2/s cannot be dosed.

To ensure maximum accuracy of the readings we recommend to allow some reasonable time for the TitroLine® 5000 to “warm up”.

Measuring input 1 (analog):

pH/mV-input with 12 bit transducer for high-precision readings.
Electrode socket according to DIN 19 262 or additional with BNC socket insert (Z 860).
Reference electrode 1 x 4 mm socket.

		Measurement range	Display resolution	Measurement accuracy* without sensor probe	Input resistance [Ω]
pH	pH	- 3.0 ... 17.00	0.01	0.05 ± 1 Digit	$> 5 \cdot 10^{12}$
mV	U [mV]	- 1900 ... 1900	1	1.0 ± 1 Digit	$> 5 \cdot 10^{12}$

Measuring input (Pt 1000):

Temperature sensor - connector for a resistance thermometer Pt 1000 and NTC 30 kOhm.
Connection: 2 x 4 mm sockets.

	Measurement range T [°C]	Display resolution	Measurement accuracy* without sensor probe
Pt 1000	- 30 ... 115	0.1	0.5 K ± 1 Digit
NTC 30	- 30 ... 115	0.1	0.5 K ± 1 Digit

Display: 3.5 inches -1/4 VGA TFT display with 320x240 pixels.

Calibration: Automatically with up to three buffer solutions, sequence during calibration optional, freely definable buffers can be input.
Default buffer solutions according to DIN 19 266 and NBS, or technical buffers:
pH = 1.00; pH = 4.00; pH = 4.01; pH = 6.87; pH= 7.00; pH = 9.18; pH = 10.00

Input: Measurement input 1: pH/mV-input with electrode socket according DIN 19 262/or BNC
Measurement input Pt 1000: Temperature sensor probe for resistance thermometer Pt 1000
(Connection sockets: 2 x 4 mm)

Power supply: power supply 100-240 V; 50/60 Hz, power input: 30 VA

Use the power supply TZ 1853 only!

* The measurement uncertainty of the sensor probe has to be taken into account as well.

RS-232-C Interface:

separated galvanically through photocoupler, Daisy Chain function available

Data bits: adjustable, 7 or **8** Bit (default: 8 Bit)
Stop bit: adjustable, **1** or 2 Bit (default: 1 Bit)
Start bit: static **1** Bit
Parity: adjustable: even / odd / **none**
Baud rate: adjustable: 1200, 2400, **4800**, 9600, 19200 (Default 4800 baud)
Address: adjustable, *(0 to 15, default: 01)*

RS-232-1 for computer, input Daisy Chain

RS-232-2 devices of SI Analytics®:
- Titrator TitroLine® 7000 / 7500 / 7500 KF / 7750 / 7800
- Sample Changer TW alpha plus, TW 7400
- Piston burette TITRONIC® 300 and 500, TITRONIC® 110 *plus,* TITRONIC® *universal*,
- Balances of the types Mettler, Sartorius, Kern, Ohaus, (for more, please contact us)
- Exit Daisy-Chain

USB Interface:

1 x USB-type-A and 1 x USB-type-B

USB-type A („master“) for connecting of USB keyboard, - printer, - manual controller, - data media (e.g. USB stick) and USB-Hub

USB-type B („slave“) for connecting a PC

Stirrer/pump: 12V DC out, 500 mA
power supply for stirrer TM 235

Housing:

Material: Polypropylene

Front keyboard: polyester coated

Dimensions: 13.5 x 31 x 20.5 cm (W x H x D), height incl. interchangeable unit

Weight: approx. 2.0 kg

Ambient conditions:

⚠ **Do not use the device in hazardous locations!**

Climate: Ambient temperature: + 10 ... + 40 °C for operation and storage
Humidity according to EN 61 010, Part 1:
Max. relative humidity 80 % for temperatures up to 31 °C,
linear decrease down to 50 % relative humidity at a temperature of 40 °C

Dosing units:

Cylinder: 20 ml and 50 ml, borosilicate glass 3.3 (DURAN®)

Valve: volume neutral cone valve made from fluorocarbon polymers (PTFE), TZ 3000

Hoses: FEP hose set, blue

Dosing accuracy:
after DIN EN ISO 8655, part 3:
Accuracy: 0.15 %
Precision: 0.05 %

1.4 Warning and safety information

The device corresponds to protection class III.

It was manufactured and tested according to DIN EN 61 010, Part 1, "**Protective Measures for electronic measurement devices**" and control devices and has left the factory in an impeccable condition as concerns safety technology. In order to maintain this condition and to ensure safe operation, the user should observe the notes and warning information contained in the present operating instructions. Development and production is done within a system which meets the requirements laid down in the DIN EN ISO 9001 standard.

⚠ For reasons of safety, the device must only be used for the range of application described in the present operating manual. Nonobservance of the intended proper use of the device may result in personal injury or damage to property.

⚠ For reasons of safety, the devics and the power supply must be opened by authorised persons only; this means, for instance, that work on electrical equipment must only be performed by qualified specialists. **In case of nonobservance of these provisions the titrator and the power supply may constitute a danger: electrical accidents of persons or fire hazard!** Moreover, in the case of unauthorised intervention in the titrator or the power supply, as well as in the case of negligently or deliberately caused damage, the warranty will become void.

⚠ Prior to switching the device on it has to be ensured that the operating voltage matches the mains voltage. The operating voltage is indicated on the specification plate (underside of the device and backside of the power supply). **Nonobservance of this provision may result in damage to the titrator and the power supply, or in personal injury or damage to property!**

⚠ **If it has to be assumed that safe operation is impossible, the device has to be put out of operation and secured against inadvertent putting to operation.** In this case please switch the device off, pull plug of the mains cable out of the power supply, and remove the device from the place of work.

Examples for the assumption that a safe operation is no longer possible,

- if the package is damaged,
- if the device shows visible damages,
- if the power supply shows visible damages,
- if the device does not function properly,
- if liquid has penetrated into the casing.
- if the unit has been altered technologically or if unauthorized personnel tried or succeeded to open the device as attempt to repair it.

In case that the user operates such a device, all thereof resulting risks are on the user!

⚠ The device must not be stored or operated in humid rooms.

⚠ **The relevant regulations regarding the handling of the substances used have to be observed:** The Decree on Hazardous Matters, the Chemicals Act, and the rules and information of the chemicals trade. On the part of the user it has to be ensured that the persons entrusted with the use of the unit are experts in the handling of substances used in the environment or that they are supervised by specialized persons, respectively.

⚠ For all work with chemicals: **Always wear protective glasses!** Please observe the memorandums of the employer's liability insurance associations and the safety data sheets of the manufacturers.

ℹ The device is equipped with integrated circuits (EPROMs). X rays or other high energy radiation may penetrate through the device's casing and delete the program.

⚠ For working with liquids, not beeing common titration solvents, especially the chemical resistance of the construction materials of the device have to be considered (see 🕮 1.3 Technical Specifications).

⚠ For the use of liquids with high vapour pressure or (mixture of) substances not being mentioned in 🕮 1.3 Technical Specifications) as allowed substances, the safe and proper operation of the device has to be guaranteed by the user. When the piston moves upwards within the cylinder, a microfilm of dosing liquid or titration solution will always remain adhered to the inner wall of the cylinder, but this has no influence on the dosing accuracy. This small residue of liquid, however, may evaporate and thus penetrate into the zone underneath the piston, and if non-admitted liquids are being used, the materials of the may be dissolved or corroded (see 🕮 8 Maintenance and Care of the Titrator*).*

2 Installation and Commissioning

2.1 Unpacking and setting up

The device has been put together especially for you (basic unit + corresponding modules and accessories), there may be differences with respect to the delivery and the accessories described in this chapter. The scope of delivery, please refer to the attached packing list. For any questions please contact us directly (see backside of this operating manual).

The device itself as well as all related accessory and peripheral parts have been carefully checked at the factory to ensure their correct function and size. Please ensure that the small accessories are also removed in full from the packaging.

The device may be placed on any flat surface.

Scope of delivery:

Titrator TitroLine® 5000 (basic unit)

- TitroLine® 5000
- Power supply TZ 1853 (100 V … 240 V) incl. some primary adapter
- Manual keypad TZ 3880
- Stand rod TZ 1548
- Electrode holder Z 305
- Hose set and titration tip
- Electrode storage vessel Z 453
- Magnetic strirrer TM 50
- Screw Cap GL 45
- Drying tube TZ 2003

2.2 Back panel of the titrator TitroLine® 5000

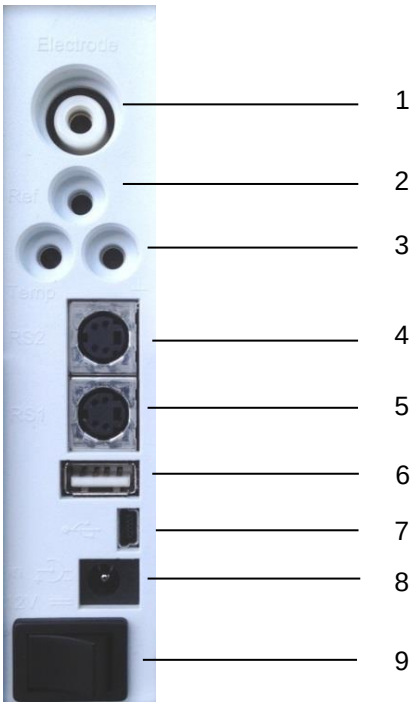

Fig. 1

The TitroLine® 5000 is equipped with the following connections:

1) Measurement input 1 (DIN or BNC through adapter) for the connection of pH, redox and other measurement or combination electrodes
2) Measurement input for reference electrodes (Ref.)
3) Temperature measurement input for connecting Pt 1000/ NTC 30 electrodes

Two RS232 ports, 4-channel (Mini-DIN):

4) RS2 for connection of a weighing balance and other devices from SI Analytics®
5) RS1 for connection to the PC

6) USB-A (“Master”) interfaces for connecting USB devices
7) USB-B interface for connection to a PC
8) Connection of the external power supply TZ 1853
9) On/Off switch

2.3 Connection and installation of the piston burette and the magnetic stirrer TM 50

The low voltage cable of the power supply TZ 1853 has to be plugged in to the 12 V socket “in”, on the back panel of the titrator. (Fig. 2). Then plug the power supply into the plug socket.

Fig. 2

⚠ Place the power supply easily accessible in order to be able to remove the device anytime easily from the power circuit.

The stirrer connects to the right side at the bottom and is locked in position by pushing it backwards (Fig. 3).
In this way the power supply of the TM 50 stirrer is automatically established.

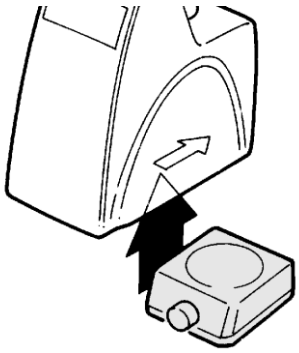

Fig. 3

The stand rod TZ 1748 is screwed into the thread and the titration clamp Z 305 may now be mounted on the stand rod (Fig. 4). Instead of the magnetic stirrer TM 50, also the titration stand without stirring function (TZ3886) can be connected.

Fig. 4

2.4 Setting the language

The ex-factory default language setting is English.

After the device is switched on and the start-up process is complete, the main menu appears (Fig. 5).

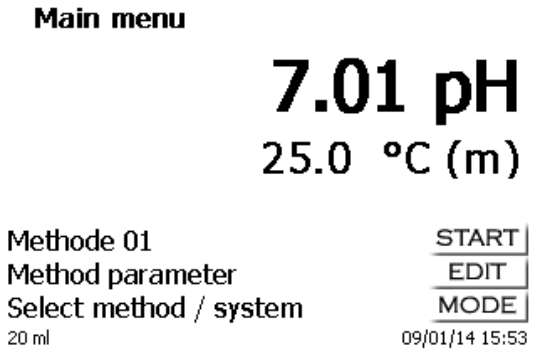

Fig. 5

Using <**SYS**> or <**MODE**>, you navigate to the system settings («**System settings**»).
The very first menu is to be used for setting the language (Fig. 6).

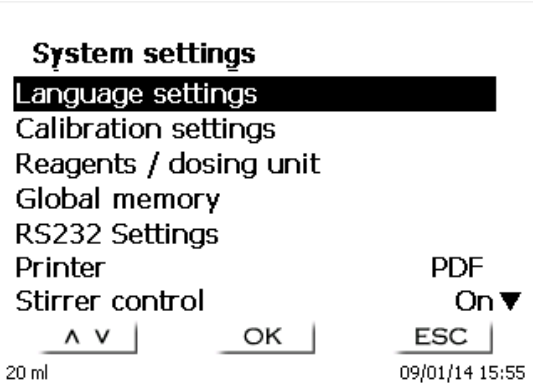

Fig. 6

Use <**ENTER**>/<**OK**> to call the menu.
Select the language using the arrow keys <↑↓>.
Confirm with <**ENTER**>/<**OK**>.

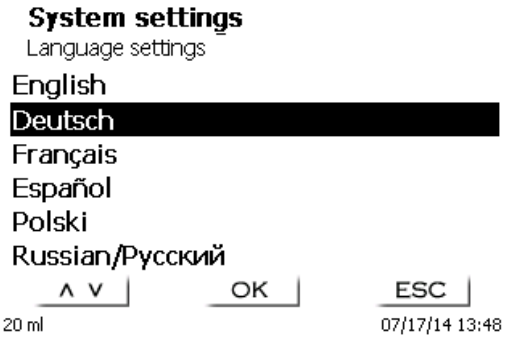

Fig. 7

The selected language will appear immediately (Fig. 7).
Pressing <**ESC**> twice will return the user to the main menu.

2.5 Dosing unit and Accessories

Fig. 8

10) TZ 2003 - Drying tube
11) TZ 3282 - Dosing hose without dosing tip and holding bracket
12) TZ 1748 - Stand rod
13) Z 305 - Titration clamp
14) TZ 3620 - Dosing hose with dosing tip and holding bracket: bracket = TZ 3875
15) TZ 3656 - Titration tip unit
16) TZ 3801 - Valve cover lid and TZ 3000 - 3/2-way valve
17) TZ 3802 - Threaded cap with borehole GL 45,
incl. adapter with 2 openings for drying tube and suction hose
18) TZ 3130 - 20 ml dosing unit or
TZ 3160 - 50 ml dosing unit
19) TZ 3283 - Connection hose
20) TZ 3281 - Suction hose

2.6 Installing the burette tip

The burette tip consists of the elements shaft with threaded clamping joint, hose and slip-on tip (Fig. 9).

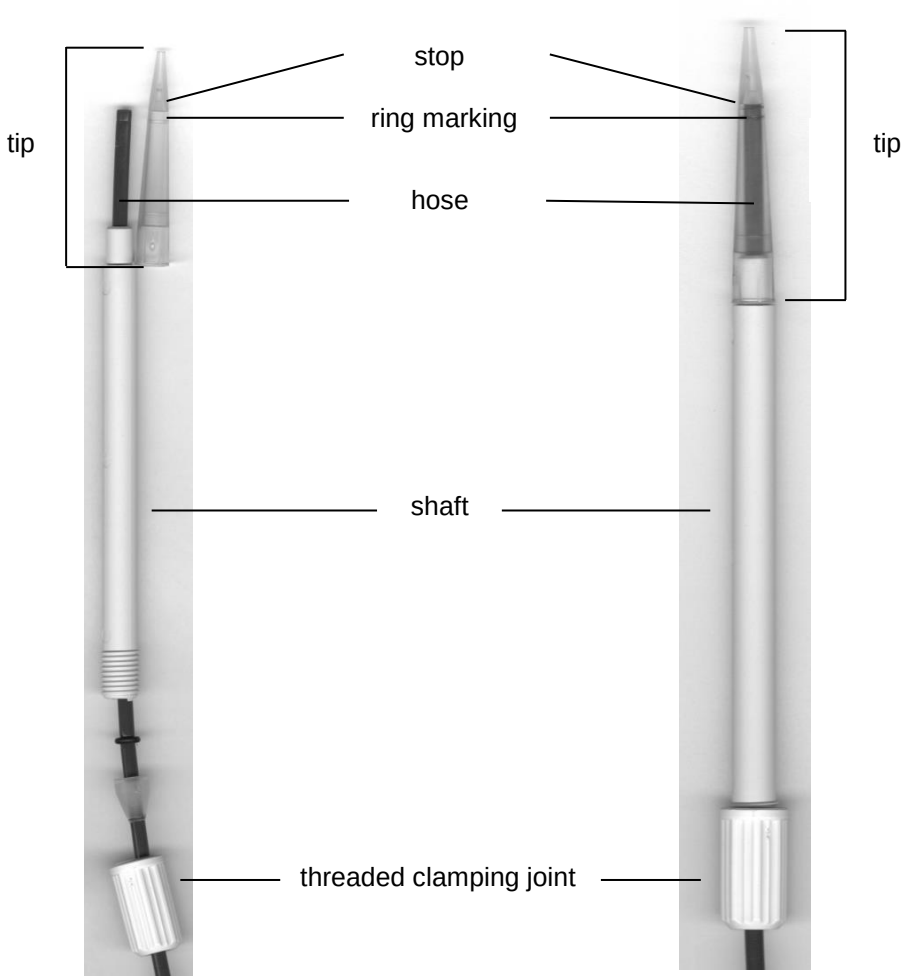

Fig. 9

Burette tip - Sequence of assembly:

1. Cut of hose end evenly.
2. Slip parts of the threaded clamping joint on to the hose.
3. Guide hose through shaft.
4. Press the free hose end over the ring marking until it reaches the stop of the tip.
5. Push the tip with pressed in hose onto the shaft.
6. Hold tip firmly, and screw threaded clamping joint to the shaft

2.6.1 Initial Filling or Rinsing of the Entire Interchangeable Unit

⚠ While the initial filling or rinsing programme is being run, please place a sufficiently dimensioned waste vessel under the titration tip.

Initial filling of the interchangeable unit is done using the «**rinsing**» program.

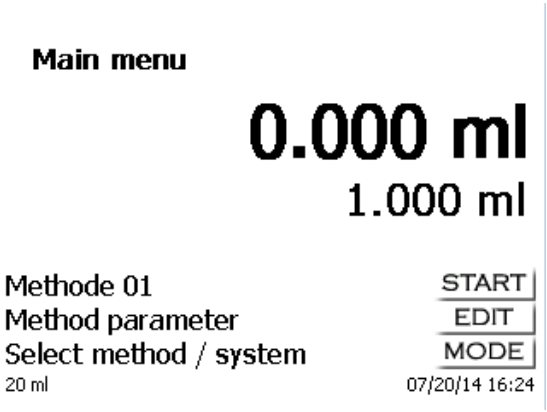

Fig. 10

On the main menu (Fig. 10), press <**MODE**> to navigate to the methods/system.
Pressing <↑> twice will take you to the «**Rinsing**» selection immediately (Fig. 11).

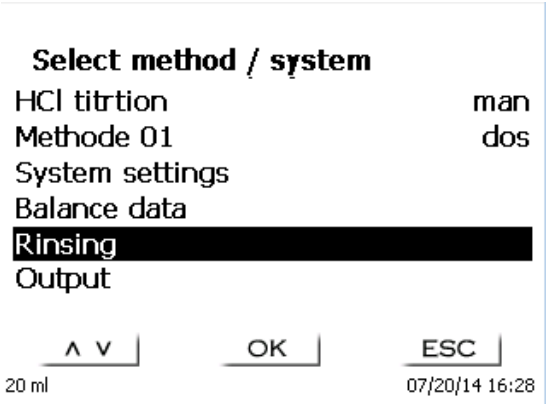

Fig. 11

Confirm the selection by pressing <**ENTER**>/<**OK**>.
At this point you can select the number of rinsing cycles (Fig. 12).

ℹ Initial filling requires a minimum of two rinsing cycles!

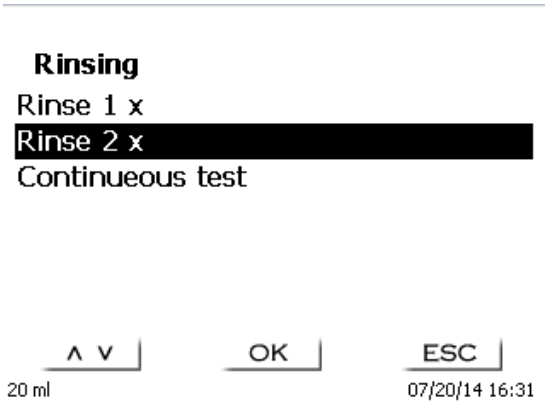

Fig. 12

Confirm the selection by pressing <**ENTER**>/<**OK**>.
At this point you can select the number of rinsing cycles (Fig. 13 - Fig. 16).

Fig. 13

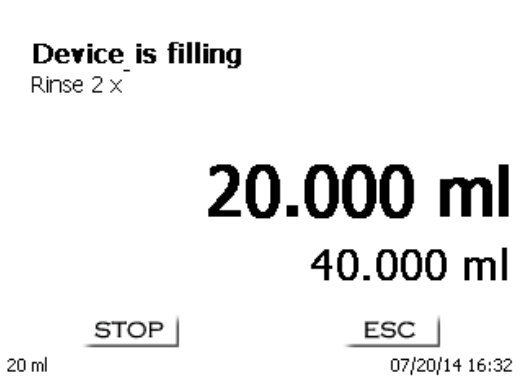

Fig. 14

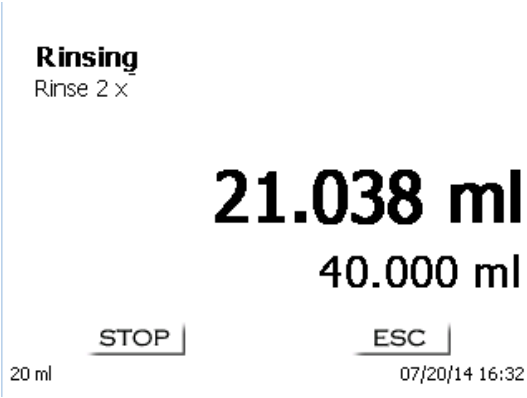

Fig. 15

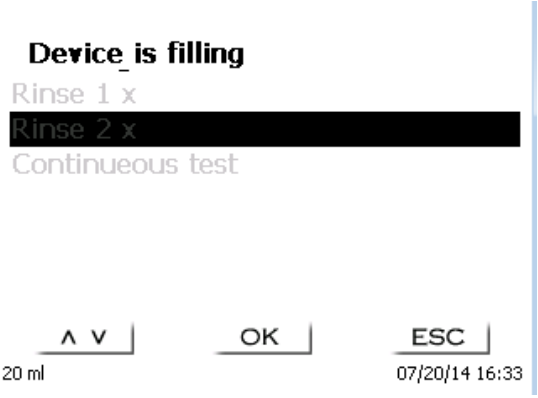

Fig. 16

You can stop the rinsing operation at any time by pressing <**STOP**> and then resume rinsing with <**START**>. When the rinsing is finished, you can get back to the start menu by pushing 2 x<**ESC**>.

3 Working with the Titrator TitroLine® 5000

3.1 Front Keyboard

Fig. 17

Apart from alphanumeric input (a-z, A-Z, 0-9) and a few other functions, almost all functions can be performed using the front keyboard (Fig. 17).

<**Mode**>: Methods selection, rinsing, system settings
<**EDIT**>: Changing the current method, new method, copy and delete method
<**ESC**>: <**ESC**> will take you back to the previous menu level
<**START**>: Start and Stop of a current method
<**FILL**>: Filling the unit

The individual functions are described in detail in 🕮 3.4 External PC Keyboard.

3.2 Display

The display (Fig. 18) consists of a graphical LCD display with a resolution of 320 x 240 pixels.
It also offers the possibility to display graphics, e.g. the measuring curve while or after the titration is/was running.

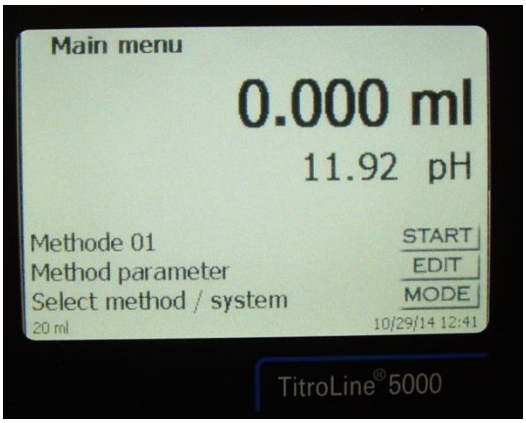

Fig. 18

3.3 Manual controller

The manual controller (Fig. 19) is needed for manual titration.
It can also be used for starting dosage or other methods.

Fig. 19

Mode	**Black key**	**Grey Key**
Manual titration	Start of titration, single-step and continuous titration	Filling Stop of titration including evaluation
Dosage through Dosage method	Start dosage	Filling
Preparation of solutions	Start dosage	Filling

3.4 External PC Keyboard

Tasten	**Funktion**
<**ESC**>	<**ESC**> will take the user to the previous level on the menu
<**F1**>/<**START**>	Start of a selected method
<**F2**>/<**STOP**>	Stop of the current method
<**F3**>/<**EDIT**>	Change of the current method, new method, copy method
<**F4**>/<**FILL**>	Fill the interchangeable unit
<**F5**>/⚖	Display and modification of the balance data. With <Shift + F5> display and modification of the global memories
<**F6**>/<**MODE**>	Selection of method, rinsing, system settings
<**F7**>/<**SYS**>	System settings (language selection, time/date ...)
<**F8**/<**CAL**>	Start calibration menu
<**F9**>/**+ / -**	Change of sign
<**F10**>/<**DOS**>	Start dosing menu
Num/ Scroll Lock/ Lock	Without function
Prt Sc Sys Rq	Without function
< ↑> < ↓ > <←> <→>	Selection of individual menus and numeric values
0...9	Input of numeric values
<**ENTER**>	Confirmation of input parameters
< ←**Backspace** >	Deletion of one input digit / an input character to the left of the flashing cursor
Letters, ASCII-symbols	Alphanumeric input possible, Uppercase and lowercase possible
All other keys	Do not have any function

3.5 Menu Structure

The menu screens shown in this manual serve as an example and may differ from what you see!

There are 5 selection menus:

- Start or main menu
- Method parameters
- Method selection
- CAL menu
- System settings.

After power-up, the main menu is always the first menu to appear.
The method displayed will always be the last method that was used (Fig. 20).

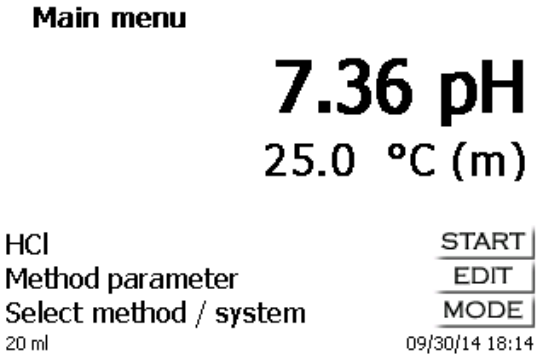

Fig. 20

Pressing <**START**> will result in the immediate execution of the method shown.
<**EDIT**> will take you to the method parameters (Fig. 21).

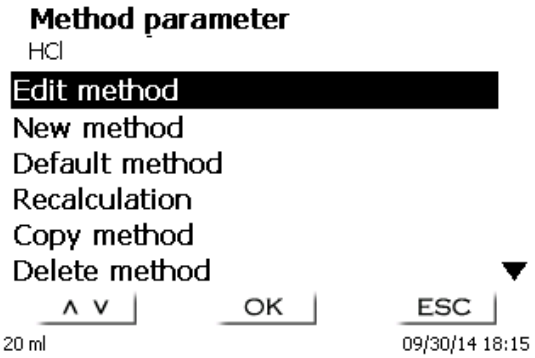

Fig. 21

At this point you can

- modify the current method
- create a new method
- call and memorise standard methods
- copy or delete an existing method
- print an existing method (only titration methods).

Use <↓> and <↑> to select the submenus.
Confirm your selection with <**ENTER**>/<**OK**>.
<**ESC**> will take you back to the main menu.

<**MODE**>/**F6** leads you to the select method menu (Fig. 22).

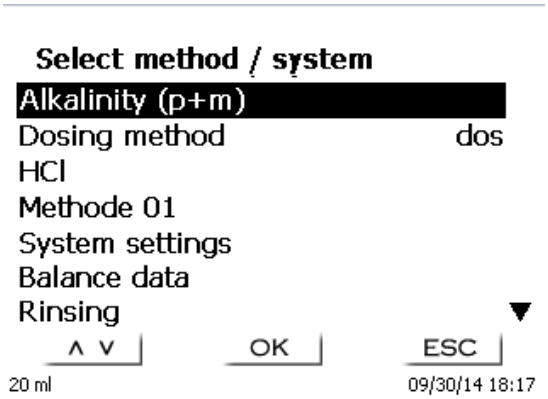

Fig. 22

Existing methods (maximum 5) can be selected by pressing <↓> and <↑> and confirming the selection with <**ENTER**>/<**OK**>. Once the selection made, you will return to the main menu with the newly selected method. If no method is selected <**ESC**> will also take you back to the main menu.

To navigate directly to the system settings (Fig. 23 and Fig. 24) you can use the <**SYS**>/**F7** key;
you can also navigate there through the method selection menu.

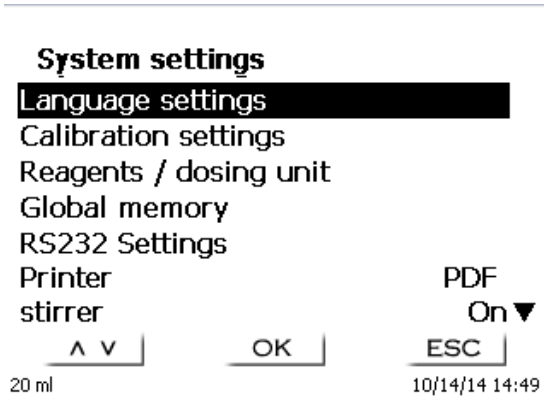

Fig. 23

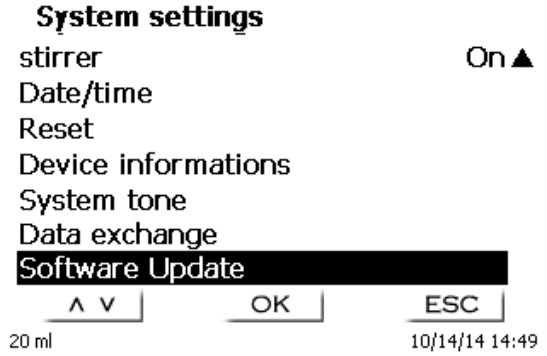

Fig. 24

3.6 Main Menu

After power-up, the main menu is always the first menu to appear.
The method displayed will always be the last method that was used (Fig. 25).

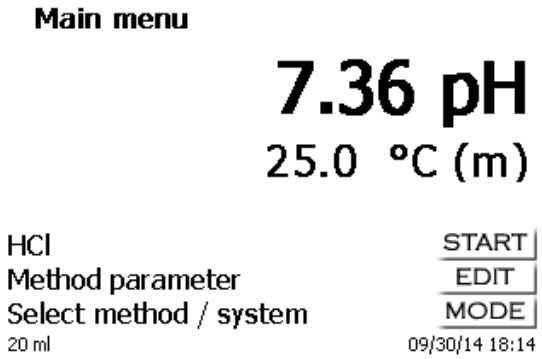

Fig. 25

3.6.1 Automatic Titration

The method being displayed can now be carried out immediately with <**START**>.

Depending on the method settings, you will be prompted for the sample identification (Fig. 26) and the weighed-in quantity (Fig. 27). You can use an external PC keyboard for entering a 20-digit alphanumeric sample ID.

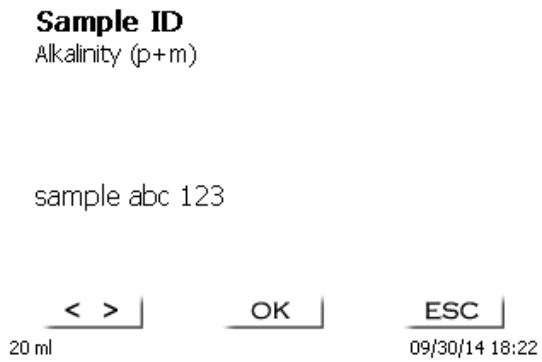

Fig. 26

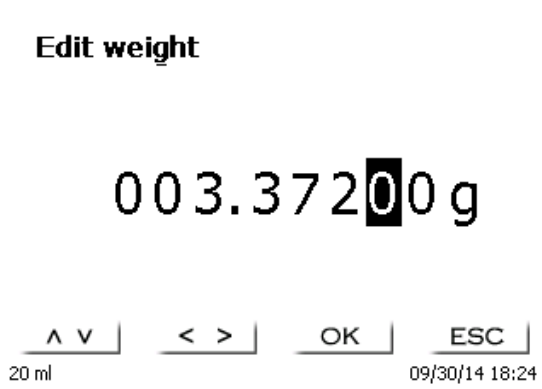

Fig. 27

The balance data can be entered using the front keyboard or an external keyboard.
The input is to be confirmed with <**ENTER**>/<**OK**>.

In the case of an automatic acceptance of the balance data, the weighed-in quantities will be read in from a memory. If the memory does not contain any balance data, a message will appear (Fig. 28).

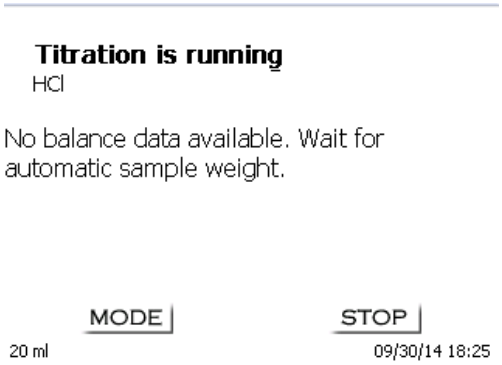

Fig. 28

Pressing the Print key will transfer the balance data, too.

Titration will then begin directly after the transfer of the balance data without any further confirmation being necessary.

The display (Fig. 29) will show the measured value (pH, mV or µA) and the current consumption.
The measured value is displayed in a slightly larger font. A status indication appears.

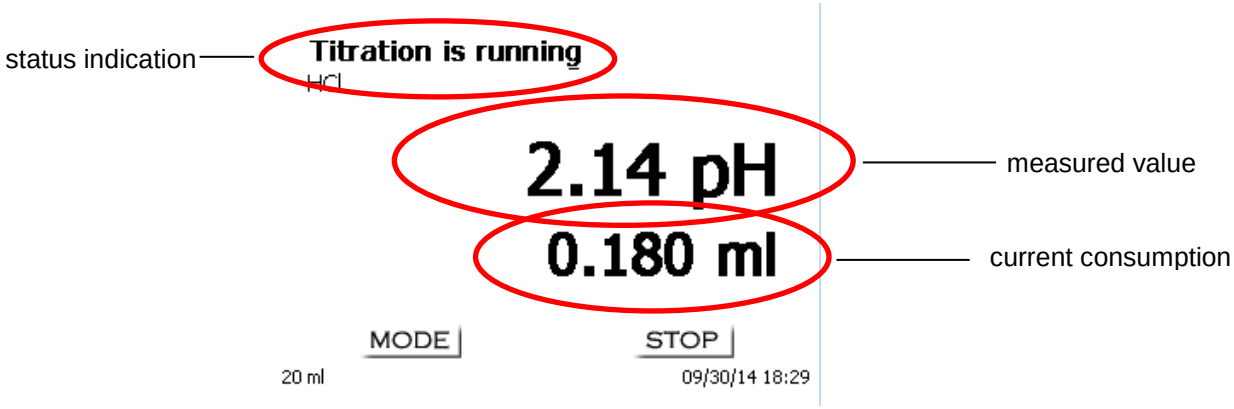

Fig. 29

Pressing the <**MODE**> will cause the titration curve (Fig. 30).

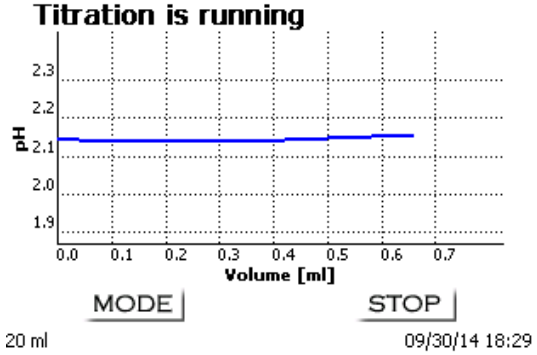

Fig. 30

The consumption in ml will be displayed on the X axis, the Y axis will show the measurement reading.
Scaling of the chart will be done automatically.

The result will be displayed at the end of the titration (Fig. 31).

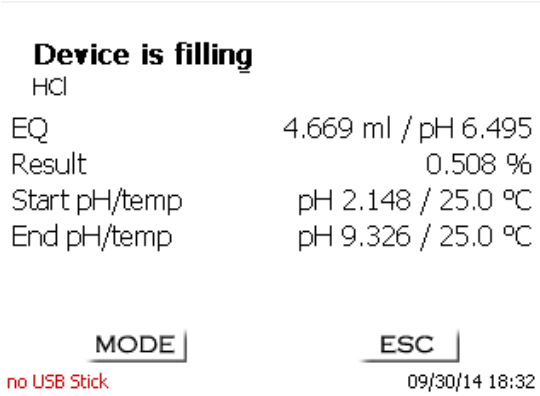

Fig. 31

<**MODE**> can be used to view the titration curve or further resuts (Fig. 32).
The pH und mV titration curves will show the measurement curve (blue) and the 1st derivation (red).
The values and the location of the equivalence point are identified directly in the curve itself.

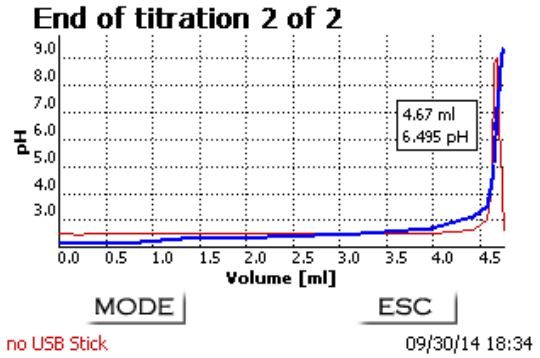

Fig. 32

If a printer is connected, the results will either be printed according to the settings made for the method, or else they will be memorised in the form of a PDF- and CSV-file file on a connected USB stick. If no printer or USB stick is connected, the bottom left corner of the display (Fig. 32) will show a message.

<**ESC**> will take you back to the main menu where you can start the next titration immediately.

3.6.2 Calibration (CAL-Menü)

If you are on the main menu (Fig. 33), calibration is started by pressing <**CAL**>.

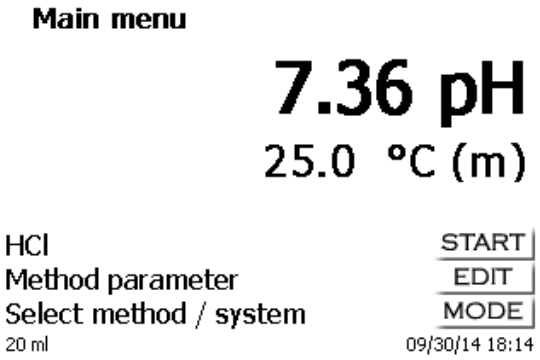

Fig. 33

The titrator will ask you to rinse the electrode and immerse it successively into 2 or 3 buffers (Fig. 34).

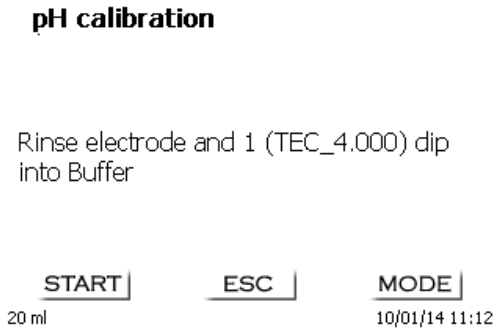

Fig. 34

The 1st buffer is started with <**START**>. The 2nd and 3rd buffers (optional) are to be started with <**ENTER**>/<**OK**>. During calibration (Fig. 35 - Fig. 37), you can view the current mV and temperature values of the buffer:

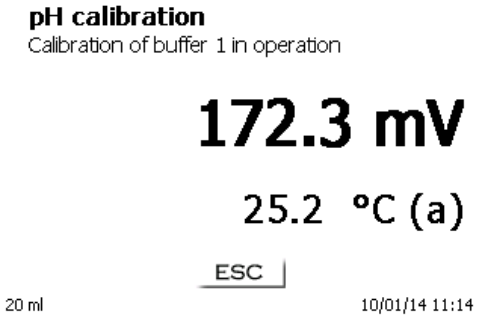

Fig. 35

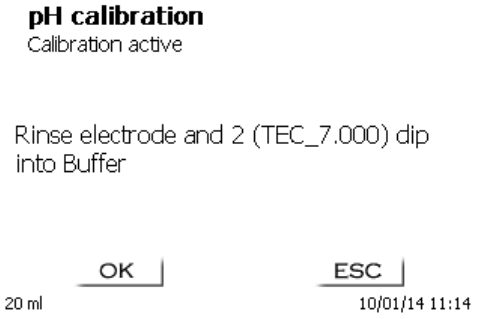

Fig. 36

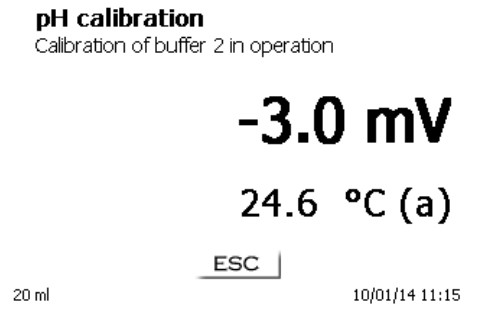

Fig. 37

Once calibration completed, the display will show the slope and the zero point of the electrode (Fig. 38).

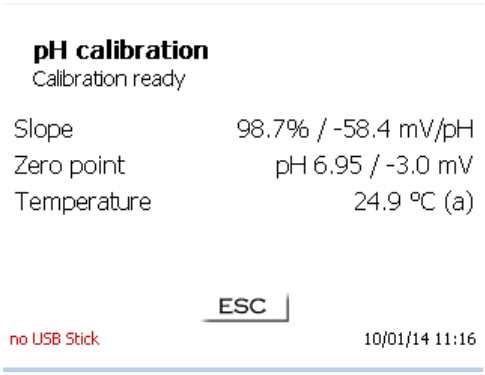

Fig. 38

The calibration values will be automatically printed or stored as a PDF file.

<**ESC**> will take you back to the main menu.

The current calibration values can be viewed at any time.
Press <**CAL**> in the main menu. The display changes (Fig. 39).

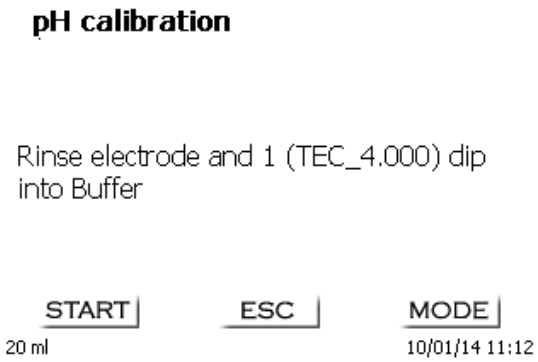

Fig. 39

Press <**MODE**> (Fig. 40).

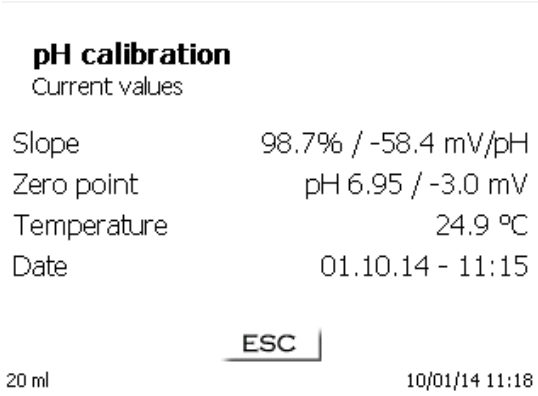

Fig. 40

3.6.3 Manual Titration

Manual titration is impossible without the manual controller.

The mV or pH reading will be displayed (Fig. 41). The value can be selected in the menu item «**Titration parameter**».

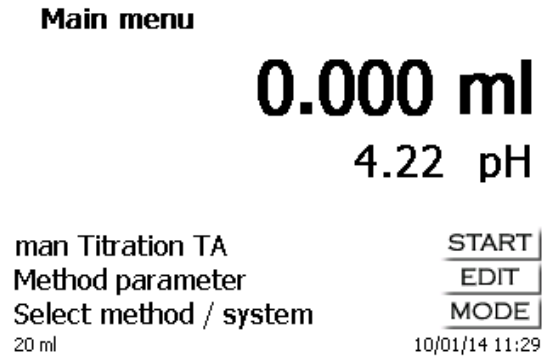

Fig. 41

<**START**> or pressing the black key on the manual controller will start the manual titration method.

Following the input of the sample description and/or the weight/volume (optional - please compare also the explanations in 🕮 3.6.1 Automatic Titration) the display changes (Fig. 42).

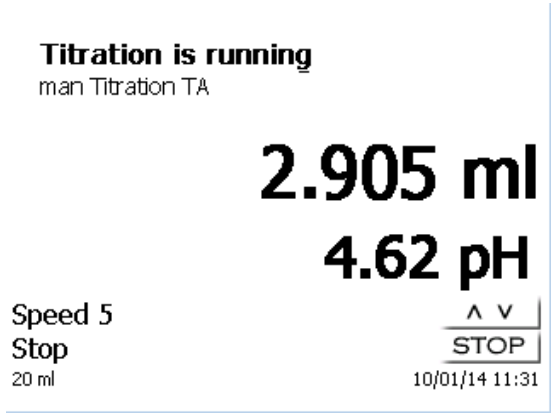

Fig. 42

You can control the metering rate with the black key of the manual controller (Fig. 42).

a) A single depression of the key will cause a step up to the first level. Depending on the size of the interchangeable unit, this corresponds to 0.0003 ml (WA 05), 0. 0005 ml (WA 10), 0. 001 ml (WA 20) and 0.0025 ml (WA 50). The increment step can be set.

b) If one keeps the black key depressed on the first level, titration will be continued at a low rate.

c) If you press the black key fully down (2nd level) titration will proceed at a higher rate.

The rate of the second level can be set in five stages using the <↓↑> arrow keys.

These stages can also be changed during manual titration (Fig. 43).

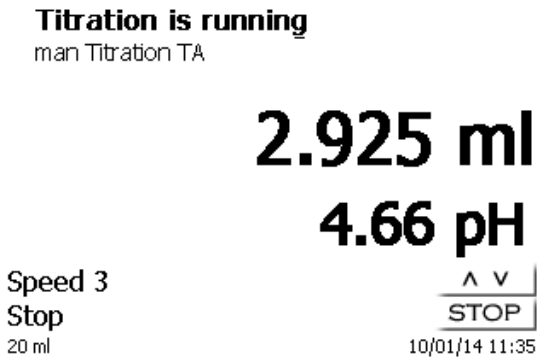

Fig. 43

Stage 5 corresponds to maximum titration speed. Speed is reduced by 50% each time.

Example:

20 ml dosing unit

Stage 5	100 %	(ca.	40 ml/min)
Stage 4	50 %	(ca.	20 ml/min)
Stage 3	25 %	(ca.	10 ml/min)
Stage 2	12.5 %	(ca.	5 ml/min)
Stage 1	6.8 %	(ca.	2.5 ml/min)

Even if the titration is completed, press <**STOP**> or approx. for 1 sec. the grey key of the manual controller.
The titration result will be calculated and displayed (Fig. 44).

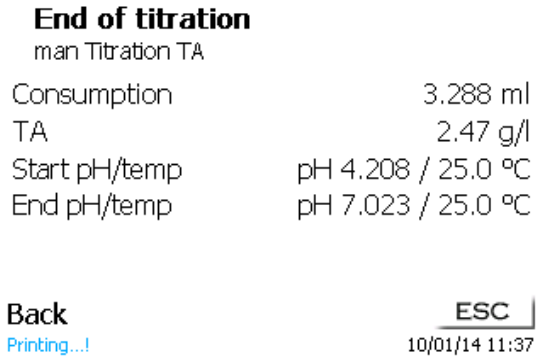

Fig. 44

The result can also be printed or stored in PDF- and CSV-format.

<**ESC**> will take you back to the start menu way to start the next titration immediately.
Filling of the interchangeable unit occurs automatically.

3.6.4 Dosage

3.6.4.1 Dosing operation with dosing method

Use <**START**> or the black key of the manual controller to start a dosage method (Fig. 45 and Fig. 46).

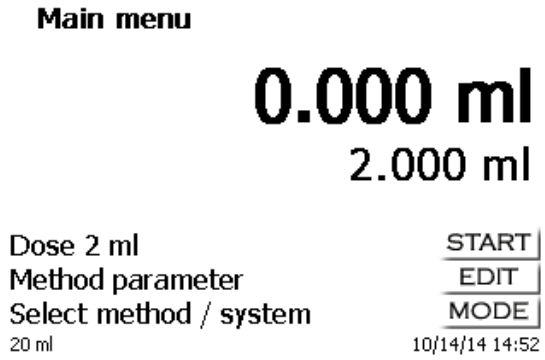

Fig. 45

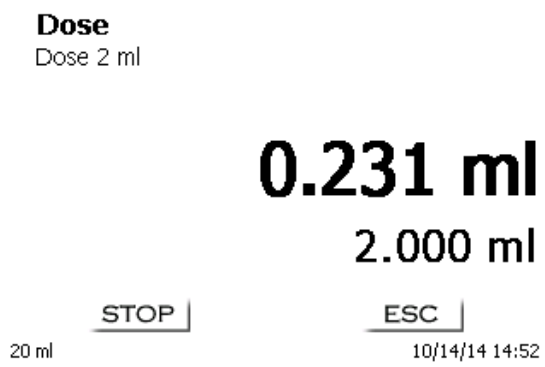

Fig. 46

The dosed volume will be briefly displayed (Fig. 47) before the display returns to the main menu (Fig. 45).

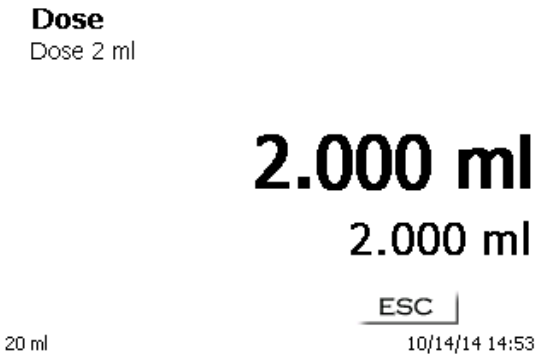

Fig. 47

The next dosage operation can be started immediately.

Filling of the unit will occur automatically.
(This option can be switched off. Then the cylinder will be filled when the maximum cylinder volume is reached).

The unit can be filled at any time using <**FILL**>.
<**ESC**> will take you back to the main menu.

3.6.4.2 Dosing operation without dosing method

A dosing operation can also be performed without any dosing method with <**DOS**>/<**F10**> of the external keyboard (Fig. 48).

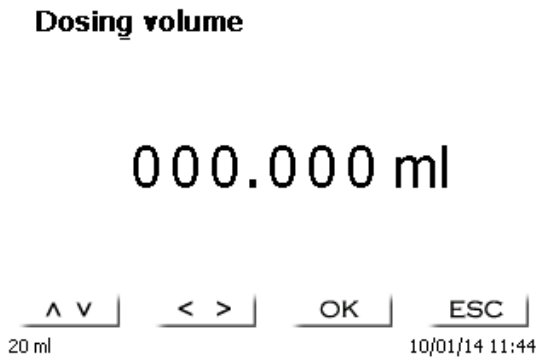

Fig. 48

The volume will be dosed with <**ENTER**>/<**OK**> (Fig. 49).

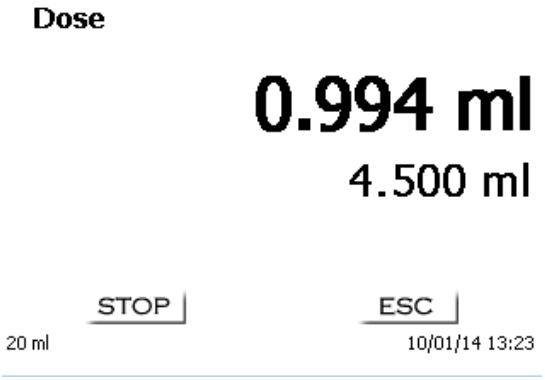

Fig. 49

The next volume can be carried out immediately with <**ENTER**>/<**OK**>.
Filling of the unit following dosage will not occur automatically here, unless the maximum cylinder volume has been reached.

The unit can be filled at any time using <**FILL**>.
<**ESC**> will take you back to the main menu.

4 Method parameters

From the main menu, <**EDIT**> will take you to the method parameters (Fig. 50).

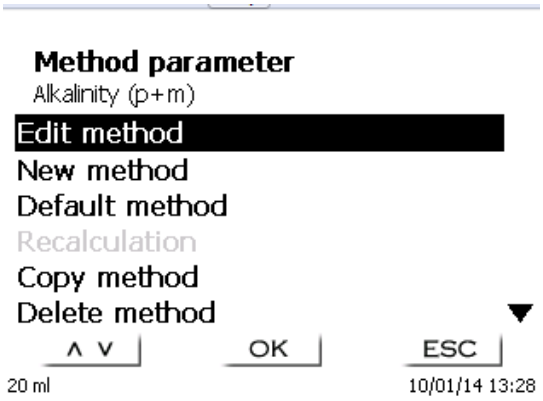

Fig. 50

4.1 Method editing and new method

If you select «**edit method**» or «**new method**» you will be taken to the modification or new creation of a method.

Selecting «**new method**» will always lead to the prompt for the input of a method name (Fig. 51).This prompt will not appear in the case of the modification of an already created method.

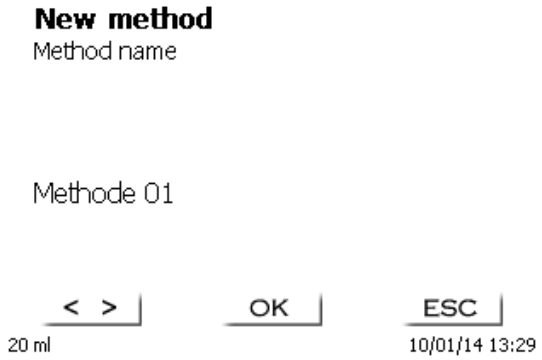

Fig. 51

The method name can contain up to 21 characters. Special characters are also possible.

If no keyboard is connected, the method name being displayed **has to be** adopted.

Numbering of methods will occur automatically. Press <**ENTER**>/<**OK**> to confirm the input.
The method name can be changed at any time.

Please continue at this point with 🕮 4.6 Change Method Parameters**.**

4.2 Default method

The «**Default methods**» item of the device contains a series of ready-made standard methods which can be conveniently selected (Fig. 52).

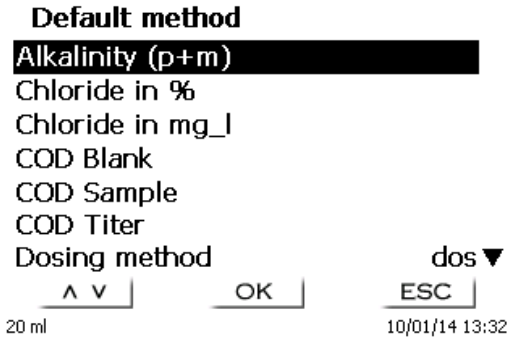

Fig. 52

Once the selection made, you are directly prompted for the input of the method name (Fig. 53).

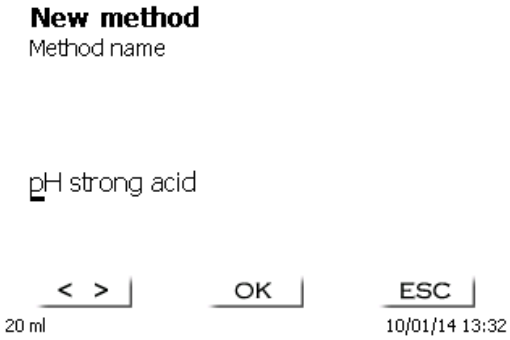

Fig. 53

The standard name may be adopted or modified.
Subsequently, you will be taken to «**Change method parameters**».

Please continue at this point with 🕮 4.6 Change Method Parameters**.**

4.3 Copy Method

Methods can be copied or stored with a new name (Fig. 54). If you select this function, the current method will be copied and you can include a new name.

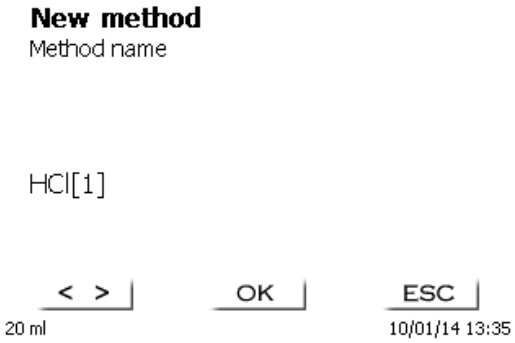

Fig. 54

ℹ A new name with the suffix [1] is assigned automatically in order to avoid the existence of two methods having the same name. Subsequently, you will be taken to <**Change method parameters**>.
Please continue at this point with 🕮 4.6 Change Method Parameters.

4.4 Delete Method

In this function you will be prompted to know whether the current method is actually to be deleted (Fig. 55). You have to reply «**Yes**» in explicit terms and also confirm this reply with <**ENTER**>/<**OK**>.

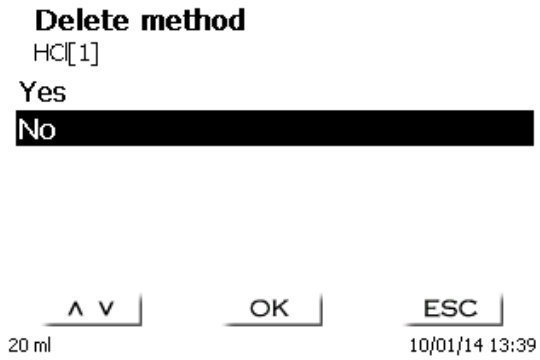

Fig. 55

4.5 Print method

The currently selected method can be printed on a connected printer or stored on an USB drive as PDF file (Fig. 56).

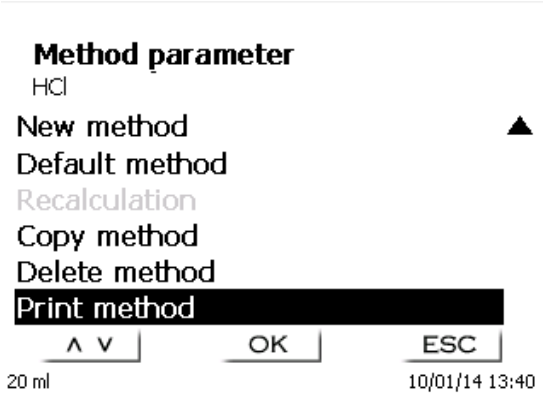

Fig. 56

4.6 Change Method Parameters

The input or modification of the method name was already described in 🕮 4.1 and 4.3

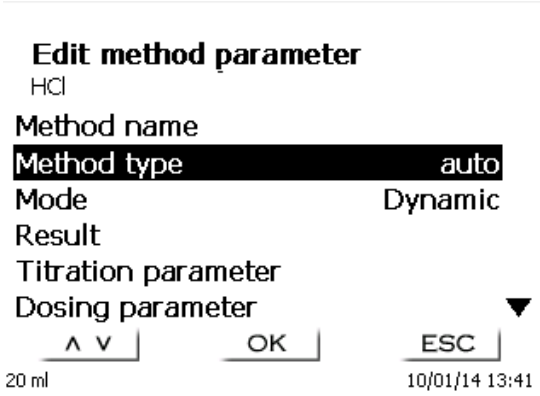

Fig. 57

4.6.1 Method type

On the «**Method type**» you can select whether you wish to perform a manual or automatic titration, a dosage or whether you wish to prepare a solution. In addition one can also carry out a measurement:

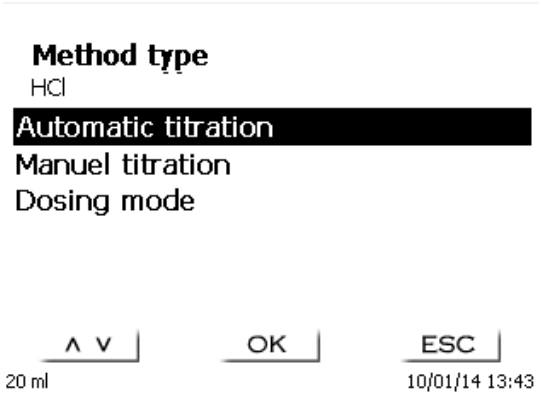

Fig. 58

The selection of the Method type will have an influence on the further parameterisation of the method
For instance, if you select the dosing mode, neither a selection of a formula nor a change of the automatic titration mode (KF and dead stop) will be available.

4.6.2 Titration mode

For an automatic titration, you can select from the following modes:

- Linear titration (pH and mV)
- Dynamic titration (pH and mV)
- End-Point titration (pH, and µA)

4.6.2.1 Linear titration

In the case of linear titration, the step size remains identical over the entire titration cycle.

Linear titration is often used for complicated or unknown samples. Complicated examples include, for instance, chloride in the trace range (-> very flat curve pattern) or titrations in non-aqueous media. If one would use a dynamic titration control in these cases, this would not yield any benefit. Depending on the parameters, the step sizes used in excessively flat curves would either be too small or too large.

Below an example of a flat and rather unsteady course of a curve (Fig. 59).

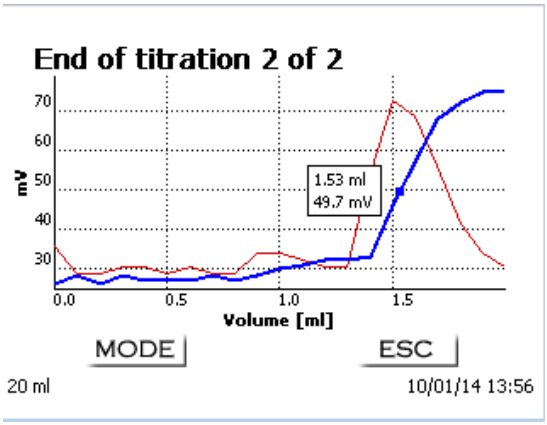

Fig. 59

Titration was performed as a linear titration with a step size of 0.05 ml. In this case, dynamic titration control with a step size adapted to the curve slope would generate an even more unsteady course of the curve. Linear Titration is only available for mV und pH titrations.

4.6.2.2 Dynamic titration

In the case of dynamic titration, the titration steps are adapted to the change of the measurement readings/ml (slope, curve gradient).

Small slope values mean a large step sizes, and large slope values indicate small step sizes. Within that section, this leads to the inclusion of most of the measurement points which are later on of importance with regard to the evaluation of the equivalence point (EQ). Dynamic titration begins with three identical small step sizes, for instance 0.01 ml, and this value is then doubled until the maximum step width is reached, for instance 0.5 or 1 ml. Should the slope values now increase in the course of titration, the step sizes will decrease down to minimum step size, for instance 0.01 ml.

In the example below (Fig. 60) titration was performed between 100 and 300 mV with the smallest step sizes (in the present case 0.01 ml).

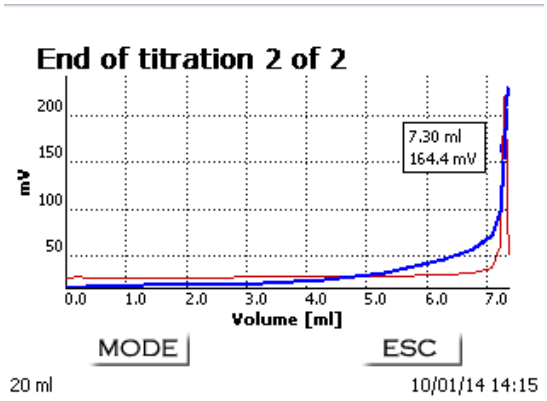

Fig. 60

With linear titration control involving step sizes of 0.05 or even 0.1 ml, only 1-2 measurement points would be recorded between 100 and 300 mV. This would result in an inaccurate calculation of the equivalence point. Dynamic titration is only available for mV and pH titrations.

4.6.2.3 End-Point titration

The goal of End-Point titration consists in titrating as precisely as possible to an end point given in terms of pH, mV or µA. In the case of pH und mV you can also titrate to two end points. Consumption in the end point will be used as a result.

The classical examples of pH End-Point titration include total acidity in wine or beverages and the p+m value (alkalinity). A classic example of µA End-Point titration is present in the determination of sulphurous acid (SO_2) in wine and beverages.

The first stage of End-Point titration consists in the continuous dosing up to a delta value away from the set end point. The dosing speed can be adjusted. Subsequently, titration is performed in a drift-controlled manner with linear step sizes between the delta value and the end point.

Example (Fig. 61): Determination of the alkalinity (m value)

pH in the point:	4.50
delta pH value:	1.00
linear step width:	0.02
dosing speed:	12 %
End-Point delay:	5 s
drift:	medium (25 mV/min)

Up to a pH value of 5.50, titration is performed with the set dosing speed. Subsequently, the method will change to a linear step size of 0.02 ml, until the end point of pH 4.50 is either reached or fallen short of. Should this value raise again to above pH 4.50 within 5 seconds, another titration step of 0.02 ml will be added. Consumption will be determined precisely at pH 4.50.

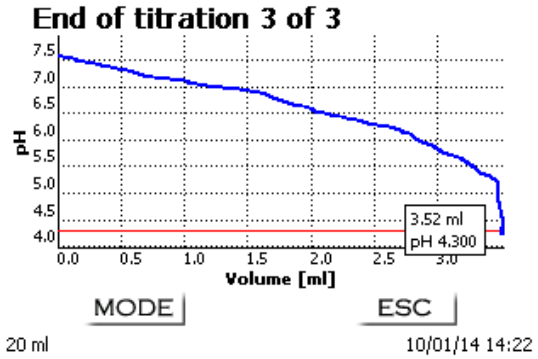

Fig. 61

4.6.3 Result

At first, the calculation options (dynamic and linear titration only) are specified (Fig. 62).

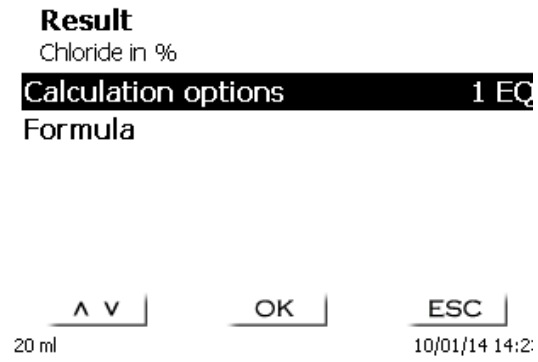

Fig. 62

One inflection points can be analyzed (Fig. 63).

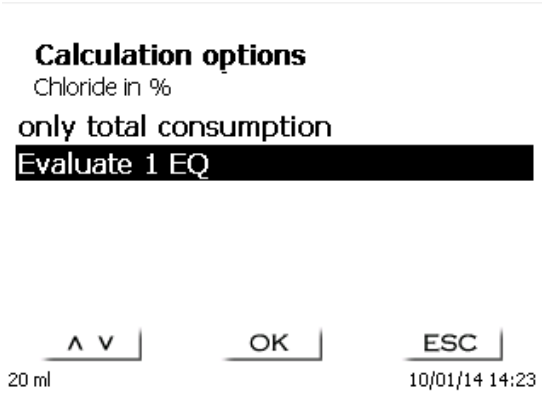

Fig. 63

With «**only total consumption**» the consumption at the last measured pH/mV value will be used.

With «**1 EQ**» the calculated equivalence points of the titration curve will be used.

«**Formula**» (Fig. 62) offers the following settings (Fig. 64).

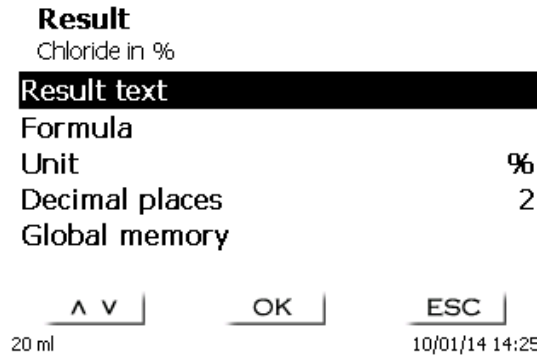

Fig. 64

The «**Result text**» may contain up to 21 alphanumeric characters including special characters (Fig. 65).

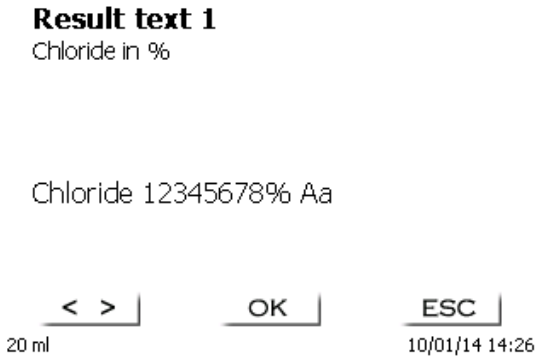

Fig. 65

Please confirm your input with <**ENTER**>/<**OK**>.
If there are two results - such as in the case of titration for two pH end points - you can enter two result texts.

4.6.3.1 Calculation Formula

The appropriate calculation formula is selected on the «**Formula selection**» submenu (Fig. 66).

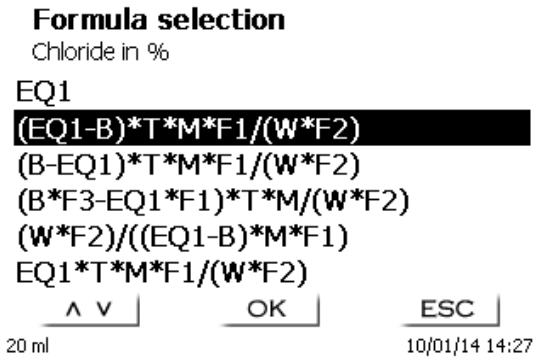

Fig. 66

The following calculation formulae are available for EQ and EP:

Formula for linear and dynamic titration to EQ1	**Formula for titrations to End-Point (EP 1 and EP2)**	**Information**
No formula		No result will be determined.
(EQ1-B)*T*M*F1/(W*F2)	(EP1-B)*T*M*F1/(W*F2)	Formula for calculating the concentration of a sample taking into account a blank value in terms of ml. Direct titration to one EQ or EP1 (ex.: chloride, p or m value)
(B–EQ1)*T*M*F1/(W*F2)	(B-EP1)*T*M*F1/(W*F2)	Formula for calculating the concentration of a sample taking into account a blank value in terms of ml. Reverse titration (examples. CSB, saponification number)
(B*F3–EQ1*F1)*T*M/(W*F2)	(B*F3–EP1*F1)*T*M/(W*F2)	Formula for calculating the concentration of a sample taking into account a blank value, including a multiplicative factor. Back titration.
(W*F2)/(EQ1-B)*M*F1)	(W*F2)/(EP1-B)*M*F1)	Formula for calculating a titer (T) of a titration solution.
(W*F2)/(EQ1-B)*M*T*F1)	(W*F2)/(EP1-B)*M*T*F1)	Formula for calculating the concentration of a sample taking into account a blank value in ml. Direct titration to one EQ or EP1.
(W*F2)/(B-EQ1)*M*T*F1)	(W*F2)/(B-EP1)*M*T*F1)	Formula for calculating the concentration of a sample taking into account a blank value in ml. Back titration (NCO-value, Epoxy-number).

The abbreviations used here have the following meaning:

ml:	Total consumption, e.g. for pH Stat
S:	Slope in ml/time (pH Stat)
EQ:	Consumption at the equivalence point 1 and 2 in ml
EP:	Consumption at the end point in ml
B:	Blank value in ml. Mostly determined by way of titration
T:	Titer of the titration solution (e.g. 0.09986)
M:	Mol; mol- or equivalence weight of the sample (e.g. NaCl 58.44)
F1 - F5	Factor 1 - 5 conversion factors
W	“Weight“, weighed-in quantity in g or volume in ml

EQ1	EP1	Calculation of the consumption in the equivalence or end point.
	EP2*T*M*F1/(W*F2)	Formula for the calculation of concentration of a sample. Direct titration to 2 EP. Here EP2 (p and m value)
	(EP2-EP1)*T*M*F1/(W*F2)	Formula for the calculation of the concentration of a sample. Direct titration to 2 EP. Here calculation of the difference between EP2-EP1.
	(F3*EP2-EP1)*T*M*F1/(W*F2)	Formula for the calculation of the concentration of a sample. Direct titration to 2 EP. Here: calculation of the difference between EP2-EP1, taking into account a multiplicative factor for EP2.
	(F1/W) * EP1 *F2	Calculation of the des TAC (**T**otal **A**norganic **C**arbonat reserve)
	((F1/W)*(EP2-EP1) * F3-F4)*F5	Calculation of the FOS (**V**olatile **O**rganic **A**cids)
		FOS/TAC-value

The abbreviations used here have the following meaning:

ml:	Total consumption, e.g. for pH Stat
S:	Slope in ml/time (pH Stat)
EQ:	Consumption at the equivalence point 1 and 2 in ml
EP:	Consumption at the end point in ml
B:	Blank value in ml. Mostly determined by way of titration
T:	Titer of the titration solution (e.g. 0.09986)
M:	Mol; mol- or equivalence weight of the sample (e.g. NaCl 58.44)
F1 - F5	Factor 1 – 5 conversion factors
W	“Weight“, weighed-in quantity in g or volume in ml

After selecting a formula, please confirm your selection with <**ENTER**>/<**OK**>.

The values for the blank value, the titers and factors F1 - F5 can be entered or read from a global memory (Fig. 67).

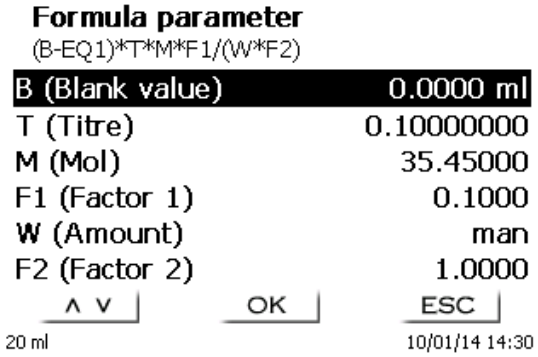

Fig. 67

The values from the global memory were defined in advance by a titration or were manually entered (Fig. 68 and Fig. 69).

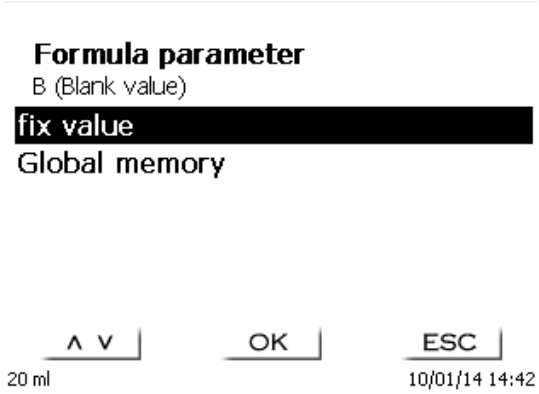

Fig. 68

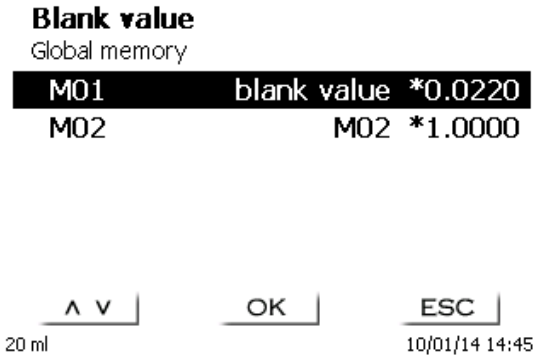

Fig. 69

The global memory used is displayed (Fig. 70).

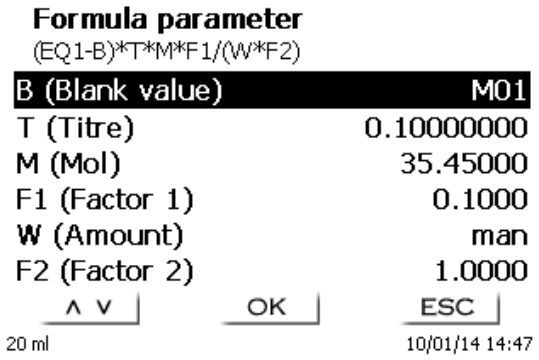

Fig. 70

Storing results in global memories is described in 🕮 4.6.3.6.

The values of the individual parameters of the selected calculation formula, e.g. mol (Fig. 71), can now be input one by one.

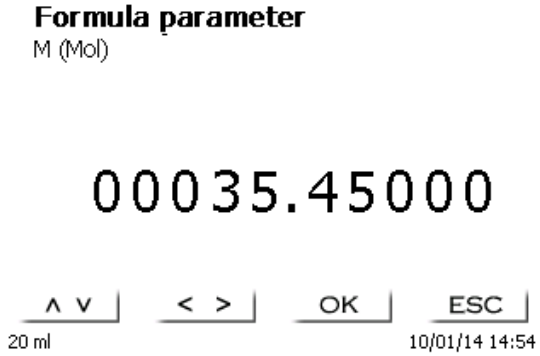

Fig. 71

4.6.3.2 Sample weight and volume (sample quantity)

The Sample Quantity (W) item (Fig. 72) is used to select whether one is wishing to use a sample weight or a sample volume for titration or solution preparation (Fig. 73).

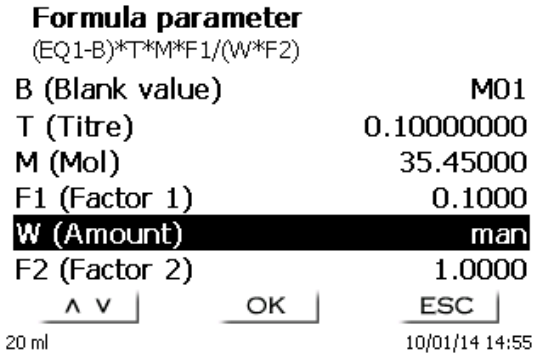

Fig. 72

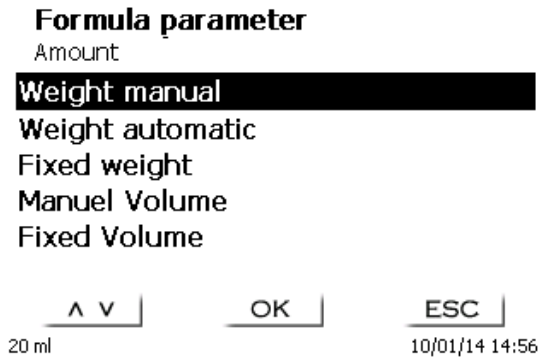

Fig. 73

You have the following options:

- «**Manual sample weight**»: The sample weight is enquired by a prompt at the start of the method and manually input.
- «**Automatic sample weight**»: The sample weight is automatically transferred by a connected balance.
- «**Fixed sample weight**»: A fixed sample weight is input in g. This weight will then automatically be used for each start of the method.
- «**Manual sample volume**»: The sample volume in ml is prompted at the start of the method and manually input.
- «**Fixed sample volume**»: A fixed sample volume is input in ml. This volume will then automatically be used for each test of the method.

4.6.3.3 Formula unit

The formula unit can be selected in the «**Unit**» submenu (Fig. 74).

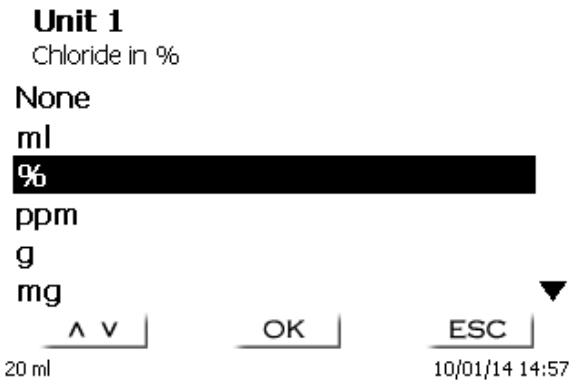

Fig. 74

Once the selection made (e.g. «**%**»), the unit will also be displayed as piece of information (Fig. 75).

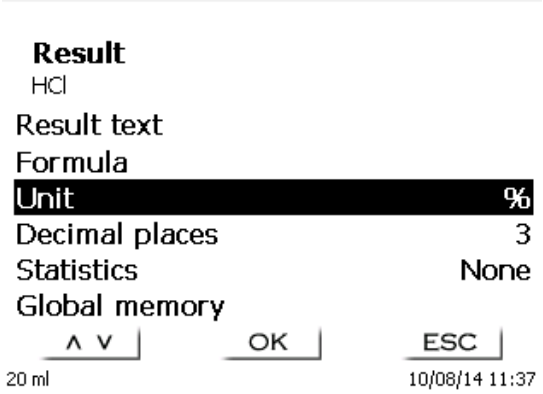

Fig. 75

By pressing the «**INS**» (Insert) key on the external keyboard, you can also add new units.

4.6.3.4 Decimal digits

To conclude, it is possible to determine the number of decimal digits from 0 - 6.
The standard setting is 2 (Fig. 76).

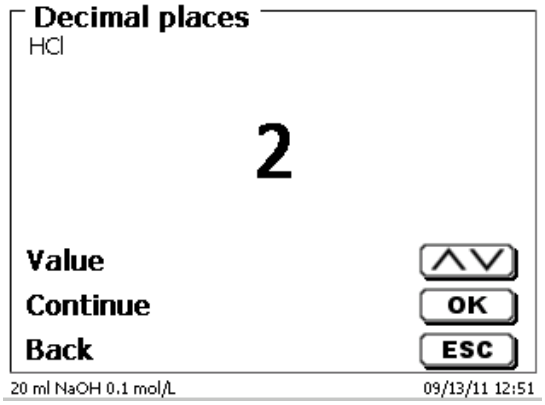

Fig. 76

4.6.3.5 Statistics

The mean value and relative standard deviation can be automatically calculated and documented by using the statistics (Fig. 77).

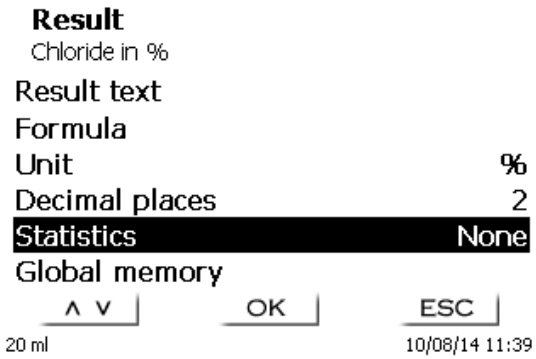

Fig. 77

The calculation of the mean value is already possible from 2 individual values, the calculation of the relative standard deviation is only possible from 3 single values (Fig. 78). The maximum quantity is 10.

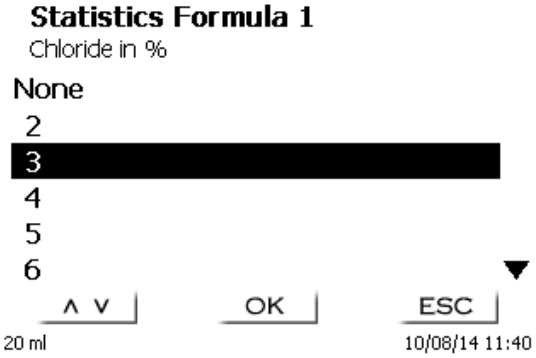

Fig. 78

The mean value and relative standard deviation (RSD) are shown directly on the display (Fig. 79).

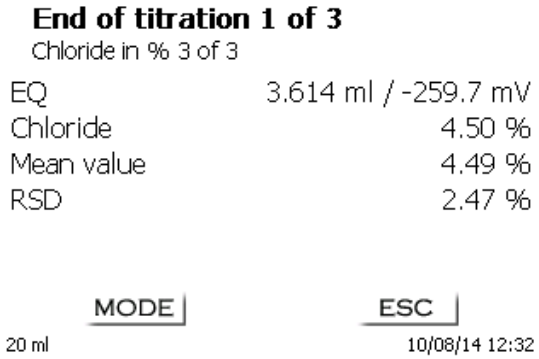

Fig. 79

4.6.3.6 Global Memories

If a titration result is to be used again later, such as the factor or titer of a solution or a blind value, this can be saved automatically. The creation of a global memory is only possible if an external keypad is used. The creation of a global memory is possible in the «**system settings**». By pressing <**SHIFT**> + <**F5**> on the external keypad, you can access the «**Global Memories**» (Fig. 80).

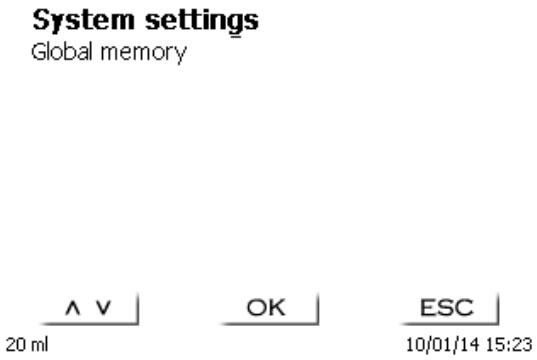

Fig. 80

Using <**F3**> it is possible to add a global memory (Fig. 81).

The name of the memory can be changed in reference to the application.

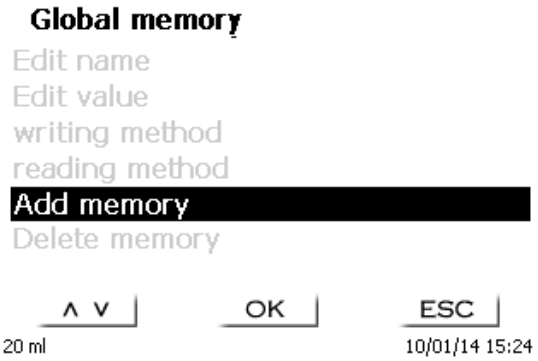

Fig. 81

The titrator proposes a memory name, such as **M01** (M01- M10) (Fig. 82).

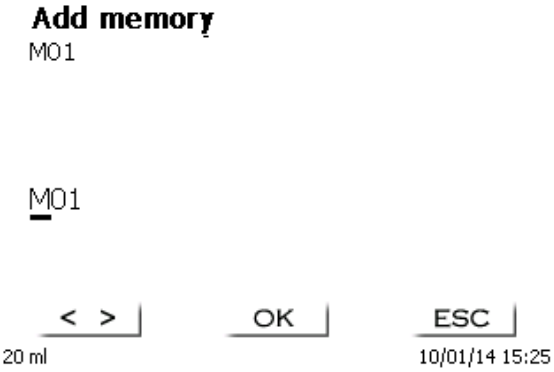

Fig. 82

M01 can be accepted or provided with a designation such as blank value or titer (Fig. 83)

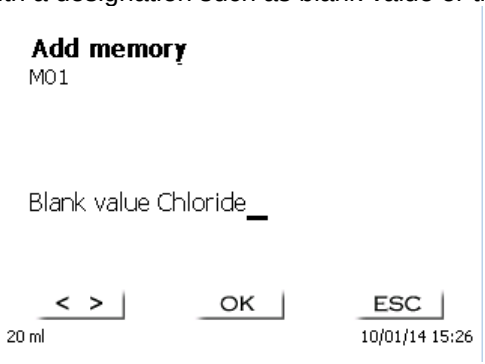

Fig. 83

This simplifies later the allocation of the global memory in another method (Fig. 84).

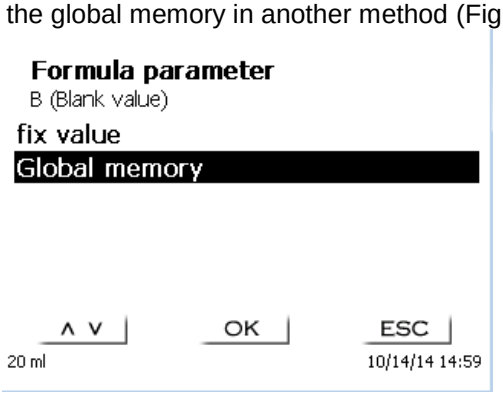

Fig. 84

The blind value which was possibly titrated in advance, is always taken into consideration automatically (Fig. 85).

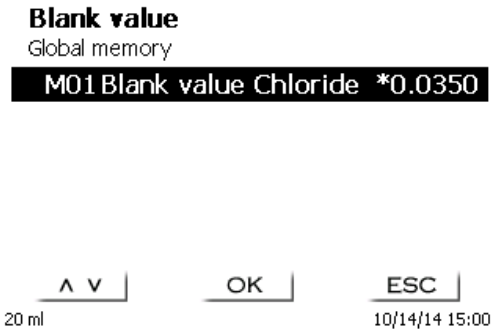

Fig. 85

Example: The blank value of a chloride titration is defined with the support of an extra method. The result in ml is thereby automatically written into global memory M01 by using the name “Blanc value” (Fig. 86). The blank value is then automatically deducted from the titrant consumption within the chloride method.

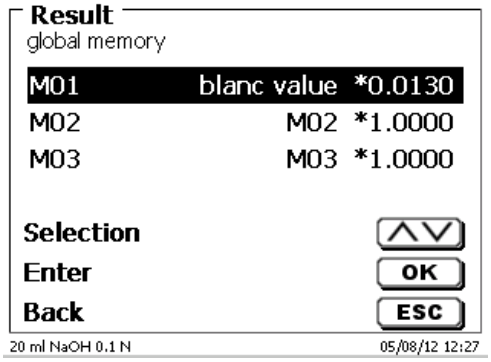

Fig. 86

4.6.4 Titration parameters

The «**Titration parameter**» submenu is used to determine the actual parameters of the method (Fig. 87 and Fig. 88).

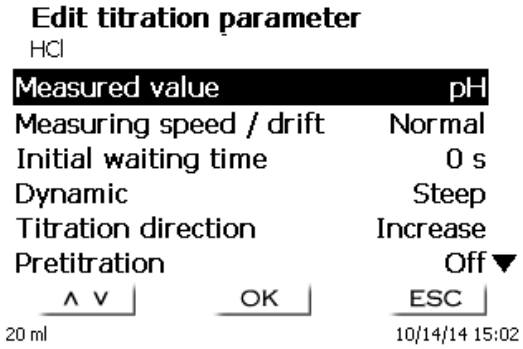

Fig. 87

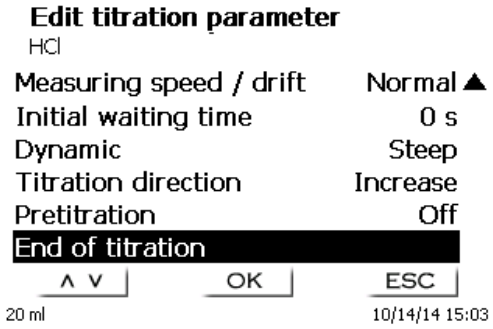

Fig. 88

4.6.4.1 Generally applicable titration parameters

Depending on the titration mode (dynamic, linear, End-Point titration), it is possible to enter a variety of parameters.

The following parameters are valid for all automatic titration modes:

- Measured value (pH and mV)
- Measurement speed
- Initial waiting time
- Pre-titration
- Titration end

The measurement speed and the titration end differ again as a function of the respective titration mode.
The «**Measured value**» is the first selection to be made, e.g. «**pH**» (Fig. 89).

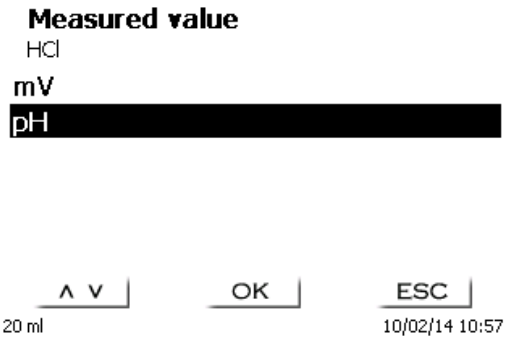

Fig. 89

The selected measured value is displayed for information (Fig. 90).

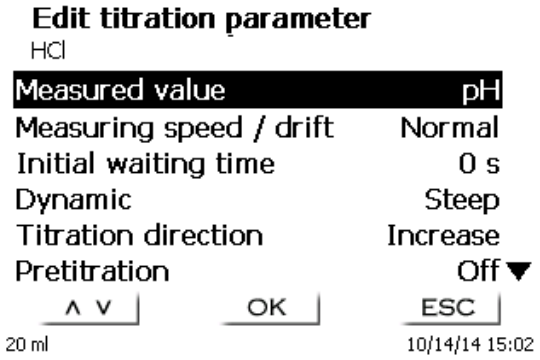

Fig. 90

«**Measuring speed**» or drift will determine the span of time after which the measured value will be accepted following a titration step (Fig. 91).

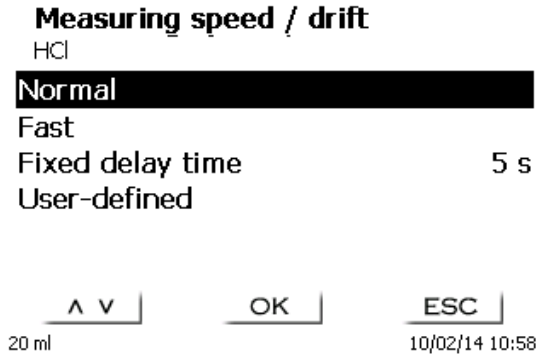

Fig. 91

Drift-controlled acceptance of the measured value in terms of mV/min is set by selecting «**norma**l», «**fast**» or «**user-defined**» (Fig. 92).

The drift values at predefined in terms of in mV/min for **normal** and **fast** drift:

Normal Drift	20 mV/min
Fast Drift	50 mV/min
Small drift value	= slow and precise
Large drift value	= fast and “less precise”

The following parameter selection can be made for **user-defined** drift setting:

Minimum holding time [s]	01 - 99
Maximum holding time [s]	01 - 99
Measuring time [s]	01 - 99
Drift [mv/min]	01 - 99

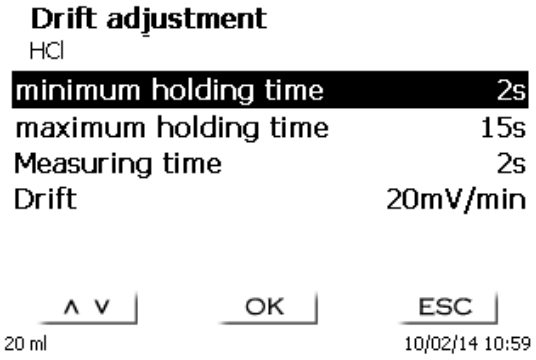

Fig. 92

If normal or fast drift was selected before, the values will be defaulted for user-defined drift. In the present case, for instance, 20 mV for normal drift: (Fig. 93).

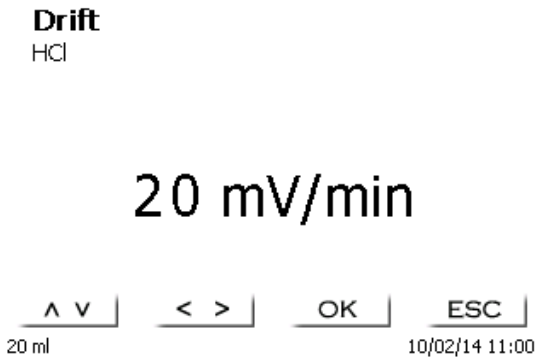

Fig. 93

Drift-controlled acceptance of the measured value is used in most applications.

However, there are applications in which the setting of a fixed holding time for measured value acceptance following the titration step is recommendable. Examples hereof include titrations in non-aqueous media. In the case of Dead-Stop titration no holding time other than the fixed one can be selected. The fixed delay time can be set between 0 and 999 seconds (Fig. 94).

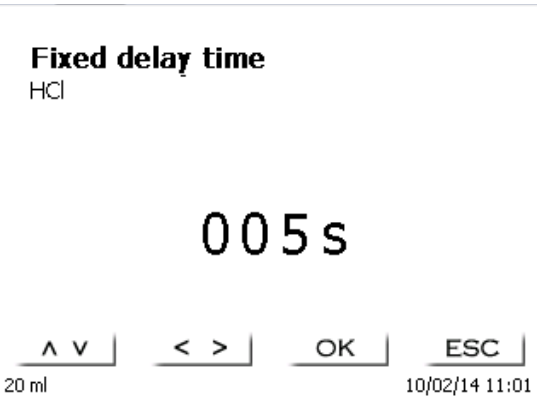

Fig. 94

After the start of titration, it makes frequently sense to have the sample stirred over a defined period of time, for instance, to allow for the sample to be dissolved. The waiting time to be observed prior to the first addition of titration solution can be set using the <**Initial waiting time**> item. The initial waiting time can be set between 0 and 999 seconds (Fig. 95).

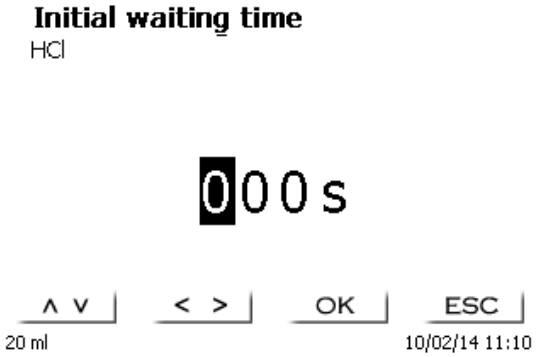

Fig. 95

4.6.4.2 Dynamic control

If dynamic control was selected, one has a selection of 3 different stages («**steep**», «**average**» and «**flat**») or «**user-defined**» dynamic parameters(Fig. 96).

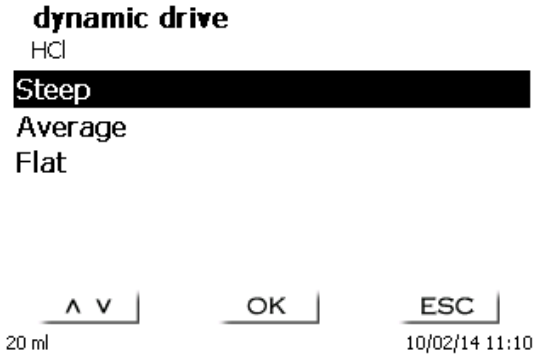

Fig. 96

On the stages, both the dynamic parameters and the minimum and maximum step sizes are defaulted

Dynamic parameters	Min./max. step size	Applications
Steep	0.02/1.0	Strong acids and alkali (HCl, NaOH, HNO_3 etc.), redox titrations such as iron (permanganometric or cerimetric), halogenides high concentrations
Average	0.02/1.0	Iodometric titrations, halogenides, medium-strength acids and alkali
Flat	0.05/0.5	Weak acids and alkali, titrations involving Ca- or Cu-ISE

4.6.4.3 Linear titration

If linear titration control was selected, you have to define the step size (Fig. 97).

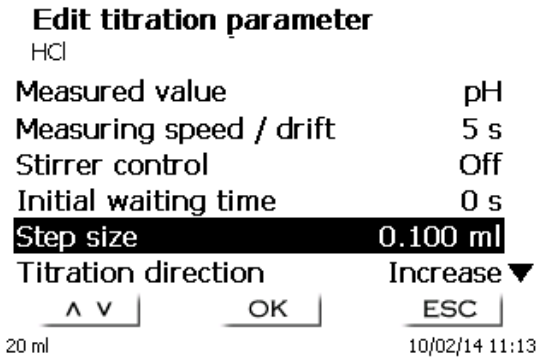

Fig. 97

Linear step size can be set from 0.0005 to 5.000 ml (Fig. 98)

Fig. 98

Linear step width can also be set for End-Point titration (pH, mV and dead stop).
In this type of titration, linear step width is used after the first continuous titration stage.

4.6.4.4 Titration direction

The titration direction can be set to «**increase**» or «**decrease**» (Fig. 99).

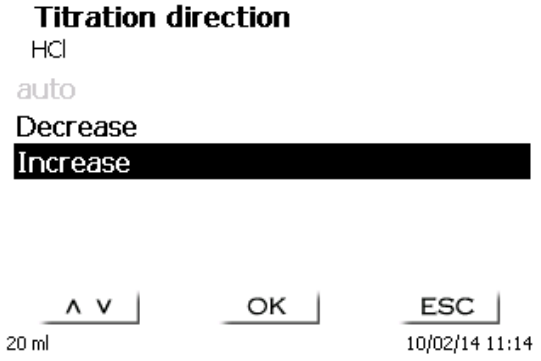

Fig. 99

Example:

increase	total acidity titration to a pH value of 8.1 using NaOH
decrease	titrating for the alkalinity (“m value”) to a pH value of 4.5 using HCl

4.6.4.5 Pretitration

If the titration agent consumption is roughly known, you can set a pretitration volume. In this process, a defined volume is dosed (= pretitrated) following the initial waiting time. After the addition of the pretitration volume, another defined span of time is observed as the waiting time before the next titration step is added. The pretitration volume is automatically added to the titration agent consumption. The pretitration volume can be set from 0.000 and 99.999 ml, the possible range for setting the waiting time following pretitration is between 0 and 999 seconds (Fig. 100).

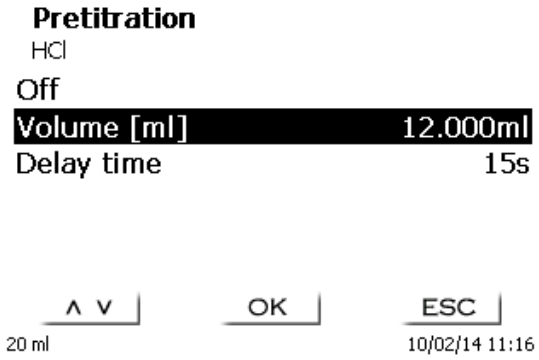

Fig. 100

4.6.4.6 Titration end

The end of a titration (Fig. 101) is reached, and the result will be calculated as soon as, if

- the defined «**End value**» pH and mV has been reached
- the criteria (steep, flat, «**slope value**») have been met for one turning point (EQ1) in the case of a linear or dynamic titration
- the predefined value ml has been reached («**Maximum titration volume**»)
- or if the titration was terminated manually by operating the <**Stop**> key.

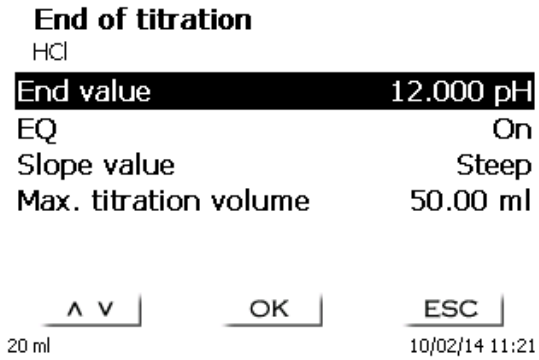

Fig. 101

It is also possible to switch off the criteria for the end value for pH and mV (Fig. 102).

The possible pH end value input ranges from 0.000 to 14.000.
The possible mV end value ranges from - 2000 to + 2000.

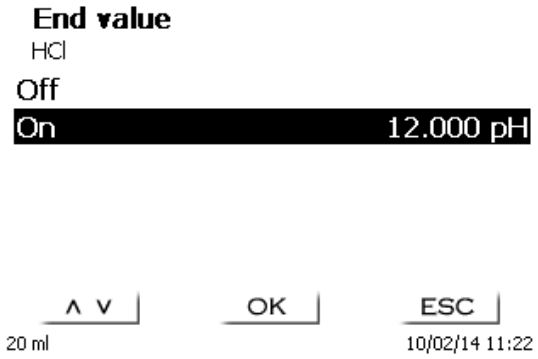

Fig. 102

Automatic detection of the equivalence point (EQ) can be switched on and off for linear or dynamic titration (Fig. 103).

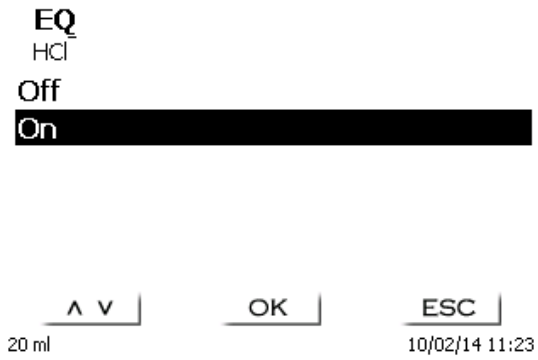

Fig. 103

If automatic EQ detection is off, titration will continue to the predefined end value in mV or pH or to the maximum ml value, respectively. Nevertheless, it is possible to calculate the EQ subsequently on the basis of the recorded measurement data.

If EQ detection is activated, you can define the slope value for the EQ (Fig. 104).

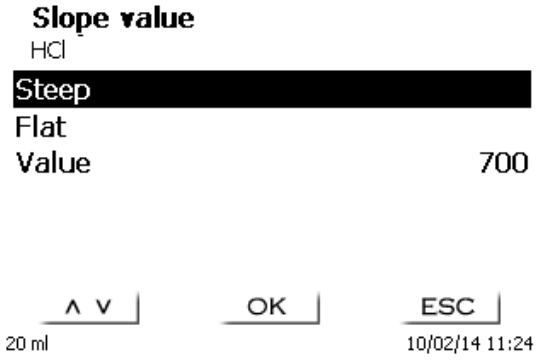

Fig. 104

The determination of the equivalence point (EQ) is done on the basis of the maximum of the first derivation (red curve) of the measurement data.

Setting of the «**maximum titration volume**» (Fig. 105) should always make sense.
It also serves as a safety criteria to prevent excessive titration, i.e. a possible overflow of the titration vessel.
The maximum titration volume can be set between 1.000 and 999.999 ml:

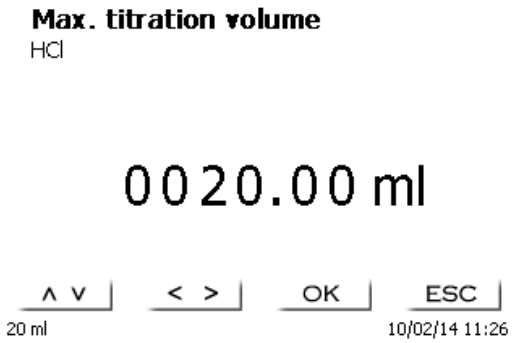

Fig. 105

4.6.5 Titration parameters “End-Point titration”

When working with End-Point titration, there are some differences in context with linear and dynamic equivalence-point titration.

As was already described in 🕮 4.6.2.3, End-Point titration, in a first stage, proceeds by continuously dosing until a specific Delta value («**Delta endpoint**») at a distance from the set end value is reached. The dosing speed of this first stage can be set in terms of % on the «**Dosing parameters**» menu. Subsequently, titration continues in a drift-controlled manner or with a fixed holding time with a linear step width between the Delta value and the end value. As soon as the end value has been reached, a defined waiting time is observed. If the end value is fallen short of, one or more than one additional titration step(s) is/are added until the end value has become stable. The waiting time at the end is referred to as «**endpoint delay**».

i In the case of an End-Point titration for two endpoints, it is possible to set both of the endpoints with different Delta values and End-Point delays (Fig. 106 and Fig. 107).

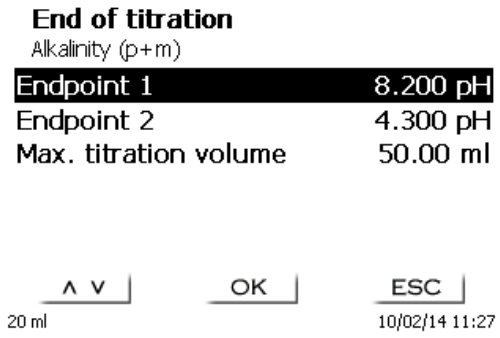

Fig. 106

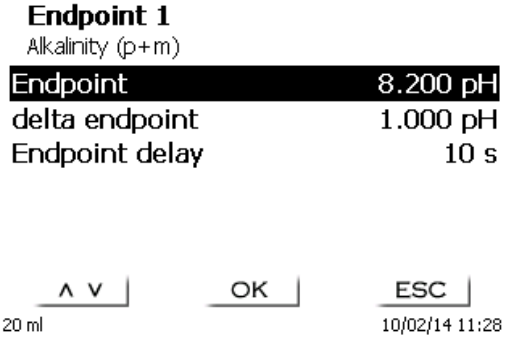

Fig. 107

4.6.6 Dosing parameter

The dosing parameters (dosing speed, filling speed and max. dosing/titration volume) are determined for each method. This applies to all types of methods such as manual and automatic titration, dosing and Solution Preparation (Fig. 108 and Fig. 109).

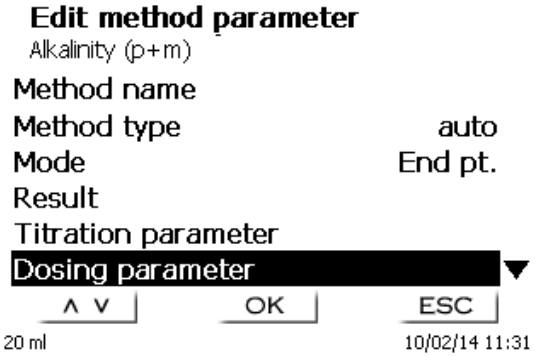

Fig. 108

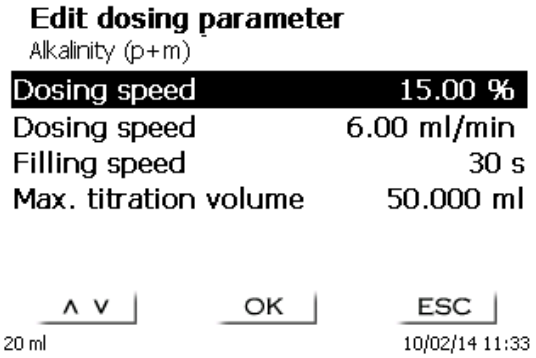

Fig. 109

The dosing speed can be set in % from 1 to 100 %.
100 % is the maximum dosing speed:

Dosing unit	Max. dosing speed [ml/min]
20 ml	40
50 ml	100

The filling speed can be set in terms of seconds from 20 to 240.

The standard setting of this value is 30 seconds.

For diluted aqueous solutions the filling speed can be six to 20 seconds. For non-aqueous solutions the filling speed should be set to the 30 seconds. In the case of highly viscous solutions such as concentrated sulphuric acid the filling speed should be further reduced down to 40 - 60 seconds.

Depending on the method type, the (maximum) the living volume or titration volume can be set to 999.999 or even 9999.999.

The following filling options can be set for the dosing mode (Fig. 110):

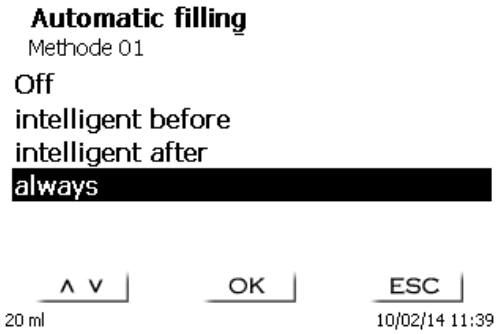

Fig. 110

«**off**»	filling it will not occur automatically after each dosing step.
«**always**»	filling will occur automatically after each dosing step.
«**intelligent before**»	a verification will be performed each time prior to the next dosing step in order to determine whether the dosing step can still be made without a filling operation. Should this prove to be impossible, the first thing to occur is filling, followed by the dosing step.
«**intelligent after**»	a verification will be performed after the next dosing step to find out whether the next dosing step can still be made without filling.

4.6.7 Sample identification

In the manual titration and in the preparation of solutions it is possible to input a sample identification (Fig. 111). The possible input includes **manual**, **automatic** or **no** sample description at all.

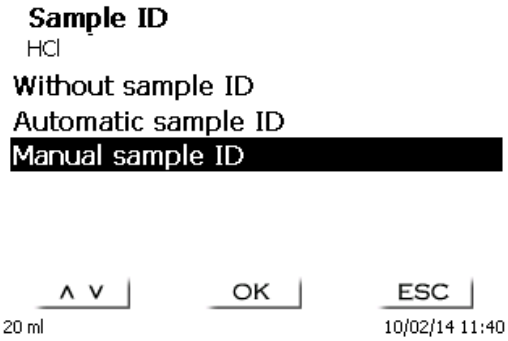

Fig. 111

For a sample description of the «**manual**», a prompt for the sample description will always be displayed at the start of the method (See also 🕮 3.6 Main Menu).
For an «**automatic**» sample description there will be selected a master description (e.g. Fig. 112 in the current case this is water), which will then automatically be numbered starting on 01.

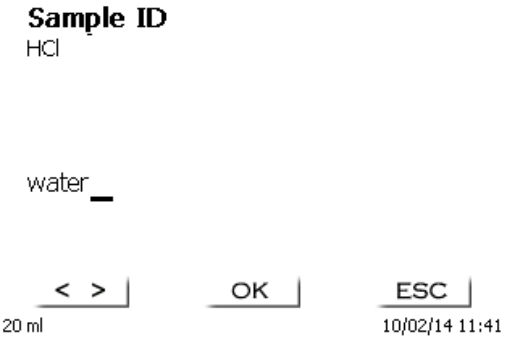

Fig. 112

After a new power-up, numbering will resume with 01.

4.6.8 Documentation

Three different format settings are available for documentation (Fig. 113) on a printer or USB device: «**short**», «**standard (with curve)** » and «**GLP**» (Fig. 114).

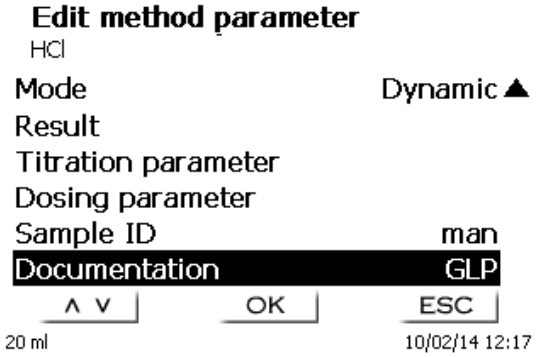

Fig. 113

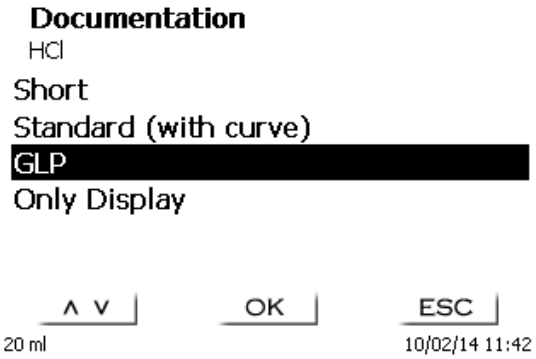

Fig. 114

Method type	Short documentation	Standard documentation	GLP-documentation
Automatic titration	Method name, date, time, duration of titration, sample description, weight/volume, starting and end measurement values (pH/ mV Temp), slope and zero point of the pH electrode, results and calculation formula	Same as 'Short documentation' + titration curve	Same as 'Standard documentation' + method contents
Manual titration	Method name, date, time, sample description, sample weight/sample volume, results and calculation formula	N/A	Same as 'Short documentation' + plus method contents
Dosing	Method name, date, time	N/A	Same as 'Short documentation' + plus method contents

.

5 System settings

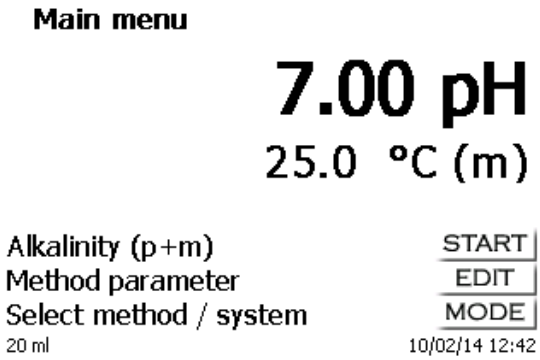

Fig. 115

From the main menu (Fig. 115) you can access the system settings with <**MODE**> (Fig. 116).

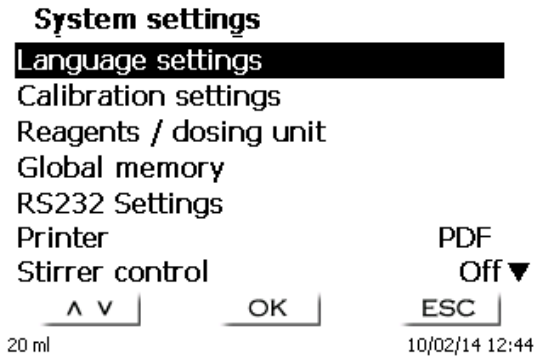

Fig. 116

Setting the national language was already described in 🕮 **2.4**.

5.1 Calibration settings

The Calibration settings item is used to select the buffers for the calibration of the pH electrode as well as to set the temperature of the buffer solution (Fig. 117).

ℹ The temperature has only to be set if neither a resistance thermometer (Pt 1000/NTC 30), nor a pH electrode with an integrated temperature measurement probe is connected.

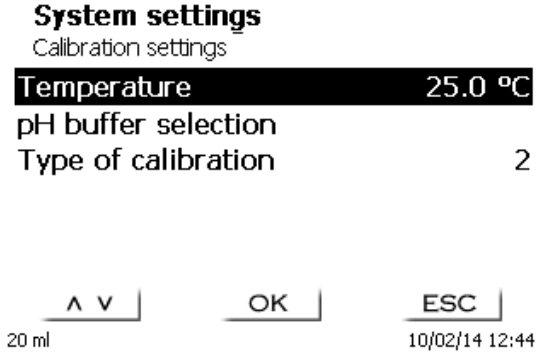

Fig. 117

The temperature can be set from 0.0 to 100.0 °C in increments of 0.1 ° (Fig. 118).

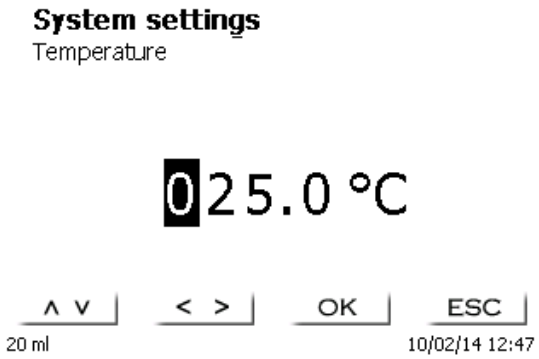

Fig. 118

The type of calibration items is used to define whether a 2-, 3-point calibration has to be performed (Fig. 119).

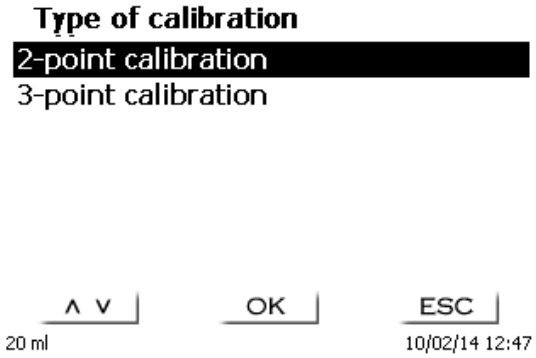

Fig. 119

The pH buffers 1 – 3 can be determined individually (Fig. 120).

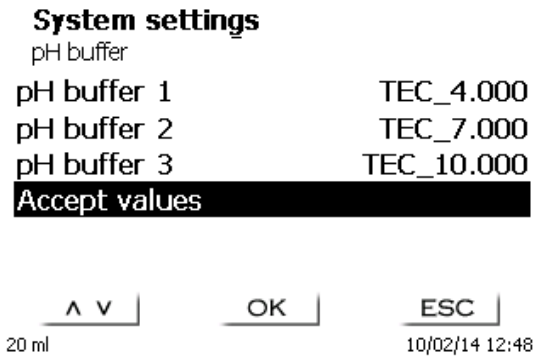

Fig. 120

A list of technical and so-called DIN/NIST buffers will appear (Fig. 121).

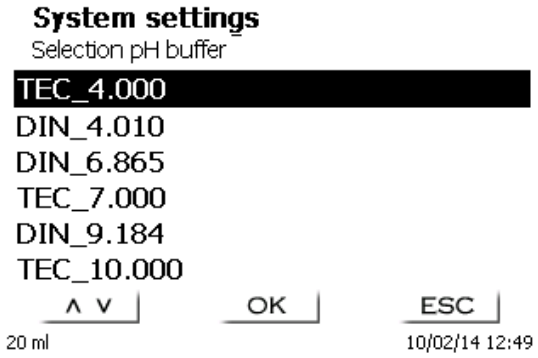

Fig. 121

After having determined the buffers, the selection is to be confirmed with «**Accept values**». If the distance between 2 buffer values is too small (for instance, buffer 1 “6.87” and buffer 2 “7.00”), an error message will appear (Fig. 122).

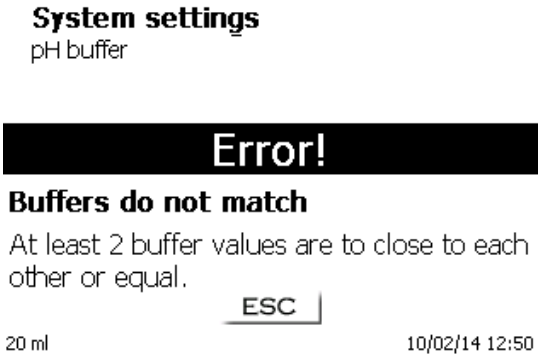

Fig. 122

5.2 Dosing unit - Reagents

You can set up the attachment size in the menu (20 or 50 ml), perform an attachment change and enter reagent data, which are put out into the GLP documentation during manual titration (Fig. 123).

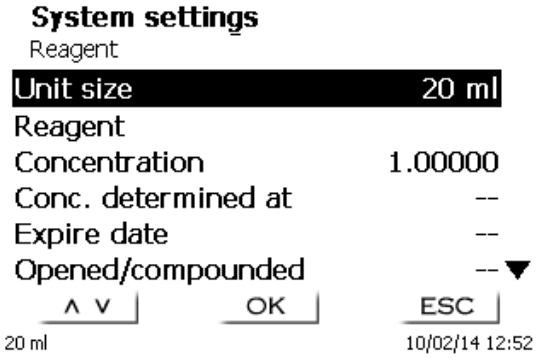

Fig. 123

5.2.1 Replacing the dosing unit

As a rule, the need for replacing the dosing unit occurs only rarely. The dosing unit has to be replaced, if such a replacement becomes necessary as a result of a defect, or of an inspection of the titration unit.

The dosing unit is equipped with lateral ribs around its circumference, with one of these ribs being in double design. This double rib serves as a mark for the correct placement of the dosing unit (Fig. 131).

With <**ENTER**>/<**OK**> confirm the «**Unit size**» and select «**Dosing unit exchange**» (Fig. 124).

⚠ **The exchange procedure starts directly with any additional warning!**
Please take care that the titration tip is placed in a beaker or in the reagent bottle.

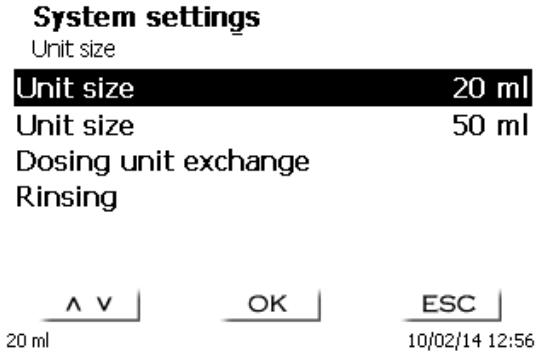

Fig. 124

The piston is raised to about 85% (Fig. 125).

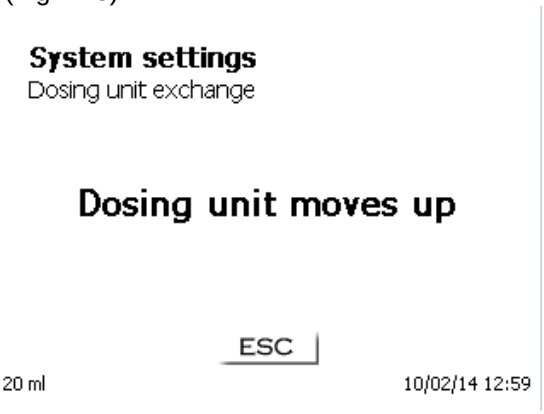

Fig. 125

Then you will be prompted to unlock the attachment (Fig. 126).

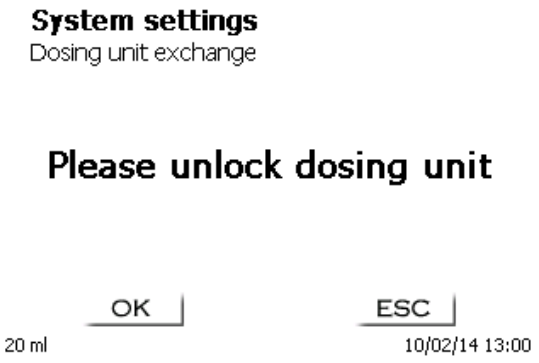

Fig. 126

Now unlock the dosing unit (Fig. 127).

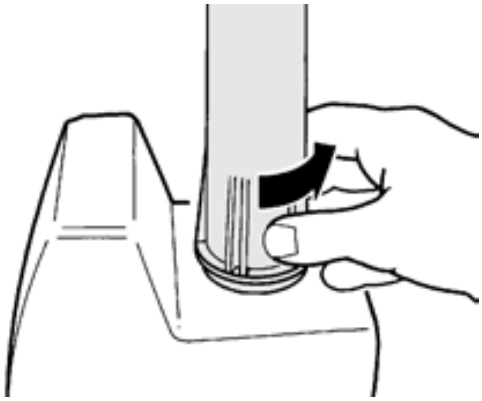

Fig. 127

Confirm with <**ENTER**>/<**OK**> after the attachment has been unlocked.
Now, the attachment will be raised all the way up (Fig. 128).

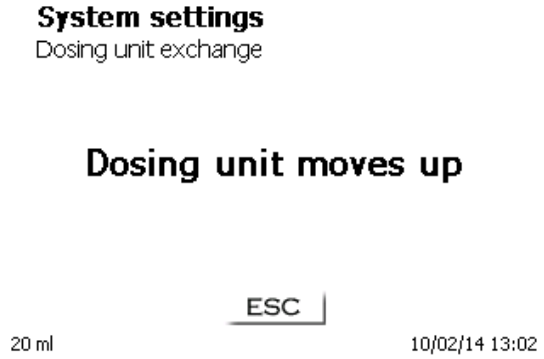

Fig. 128

You can now change the attachment (Fig. 129).

Fig. 129

Pull the attachment off toward the top (Fig. 130).

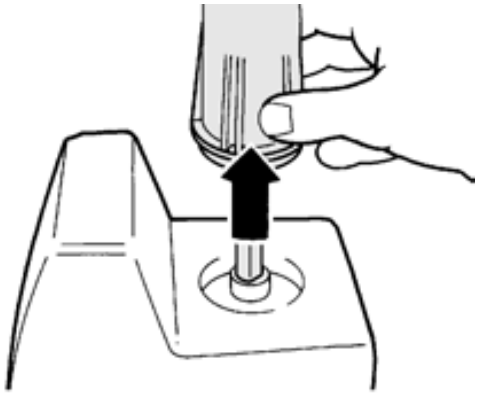

Fig. 130

Attach the new dosing attachment in the same manner (Fig. 131).

The two struts of the UV protection must match up with the marking on the housing!

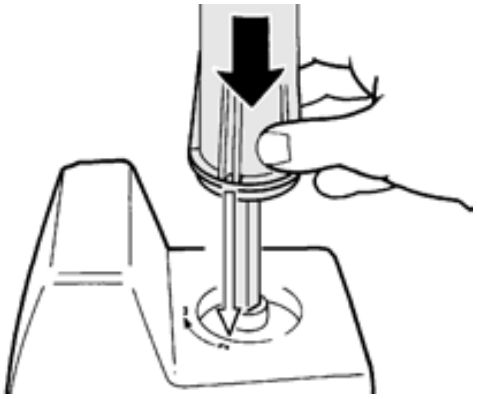

Fig. 131

Confirm with <**ENTER**>/<**OK**>

If you changed the attachment size, you can select the size here now (Fig. 132).

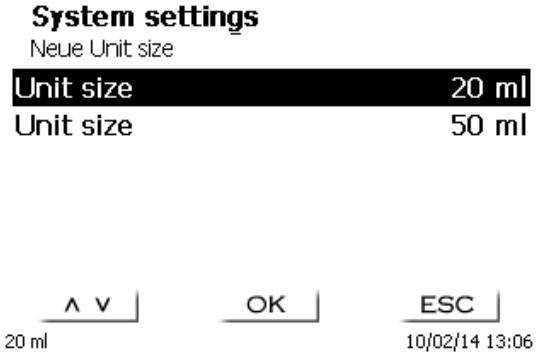

Fig. 132

If you want to change reagents, you can reset the data completely (Fig. 133).

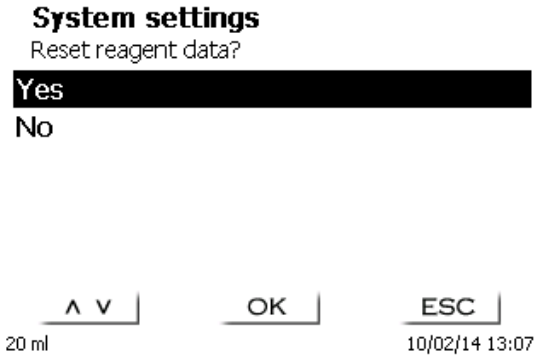

Fig. 133

The attachment then moves down again (Fig. 134) and you will be asked to lock the attachment (Fig. 135).

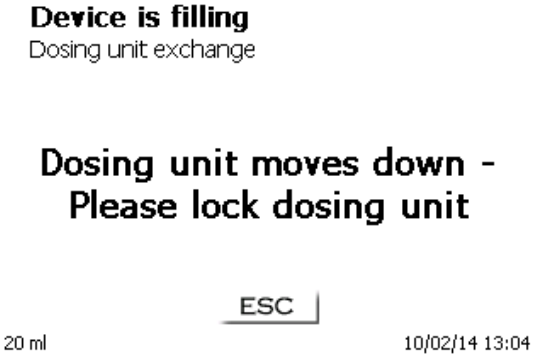

Fig. 134

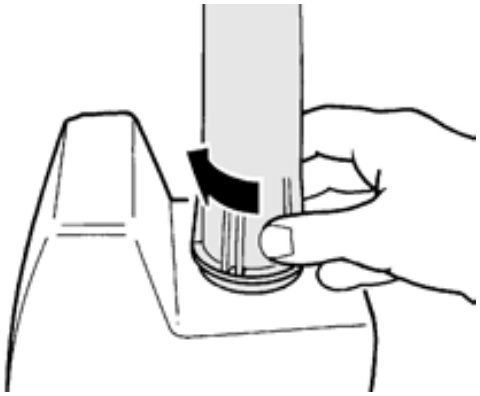

Fig. 135

The following reagents can be entered (Fig. 136 - Fig. 137):

- Unit size 20 or 50 ml (selectable)
- Reagent name (default: empty)
- Conzentration (default: 1.000000)
- Concentration determined on (default: empty)
- Expire date (default: empty)
- Opened/Produced on: (default: empty
- Test according to ISO 8655: (default: empty)
- Batch ID: (default: empty)
- Last modification (default: current Datum).

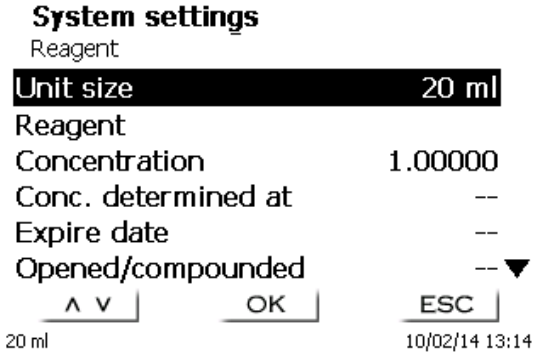

Fig. 136

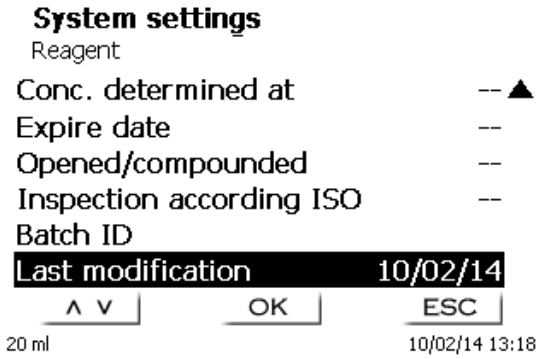

Fig. 137

5.2.2 Replacing the titration solution

If titration solutions are to be changed, since differing analysis methods are used, one should first consider whether the time required for frequent changes is not more expensive than the acquisition of another dosing unit.

As a principle and in the case of all piston/cylinder- systems, a substitution of the titration solution by another one involves mixing and carry-over processes. The reason for this is the dead volume above the piston in the cylinder and in the hoses. The disturbances to be anticipated are the greater, the more the new solution differs from the previous type and concentration. In the case of highly different solutions, the first substitution liquid (rinsing) should be distilled water, and the new titration solution should be filled in only subsequently.

The possible disturbances are very much different in the individual cases and cannot be predicted without knowledge of the specific case. Therefore the replacement of titration solutions must always be performed under the supervision of experts who ensure the correctness of the future analyses.

If the decision to change the titration solution has been made, the first thing to do is to remove the dosing unit as it is described in 🕮 5.2.1. If possible, the residue of the titration solution should be removed by hand by carefully pushing the projecting piston rod towards the hoses. When doing so, more liquid will leak out of the titration tip, and the residual volume is furthermore reduced. Removing the old titration solution can be accelerated by moving the piston rod of the dosing unit positioned top down. The suction hose is then immersed in the new solution or in water as intermediate liquid. By moving the piston several times in both directions (pumping) the previous liquid is gradually replaced by new liquid. Subsequently, the dosing unit is set on again according to the description in 🕮 5.2.1.

5.3 Globale Memory

The handling with the global memories is already described in 🕮4.6.3.6 Global Memories.

5.4 RS-232 Settings

The «**RS232 settings**» item can be used to determine the device address of the TitroLine® 5000 and set the parameters of the two RS-232 interfaces independent from each other (Fig. 138).

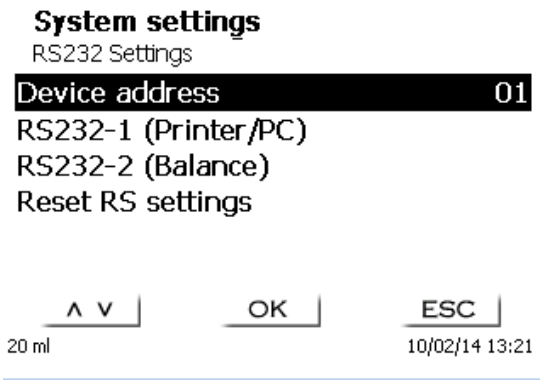

Fig. 138

The device address can be set from 0 - 15. Address 1 is the default setting (Fig. 139).

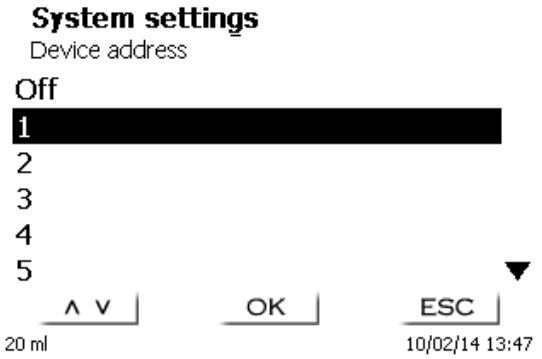

Fig. 139

The baud rate is preset to 4800 (Fig. 140).

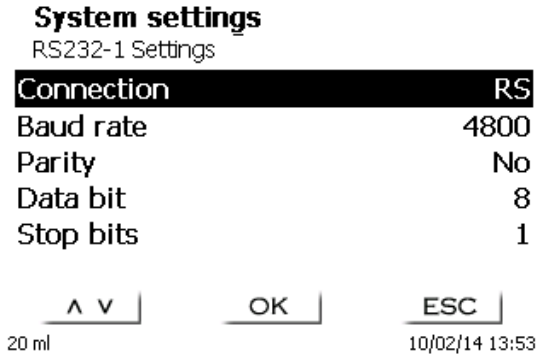

Fig. 140

It may be set to 1200 - 19200 (Fig. 141).

Fig. 141

The parity can be selected amongst «**No**», «**Even**» and «**Odd**». «**No**» is the default setting (Fig. 142).

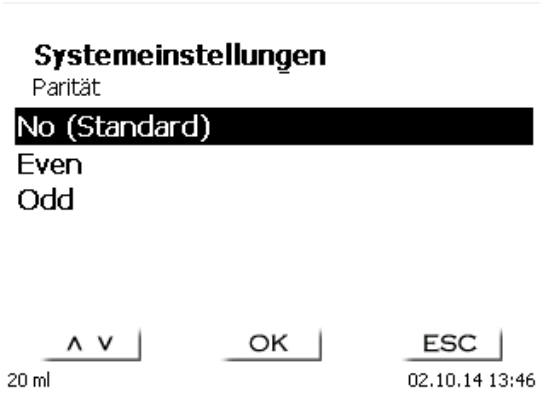

Fig. 142

You may select between 7 and 8 data bits. 8 bits is the default setting (Fig. 143).

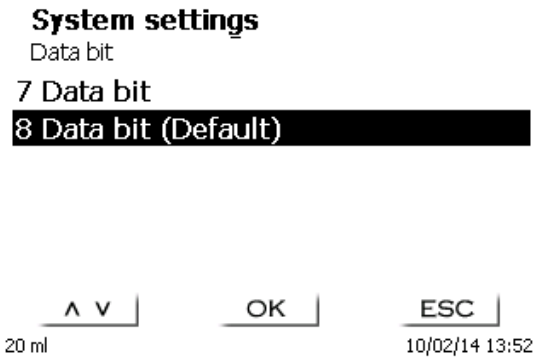

Fig. 143

You can set data bits at 1, 1.5 and 2. 1 bits is the default setting (Fig. 144).

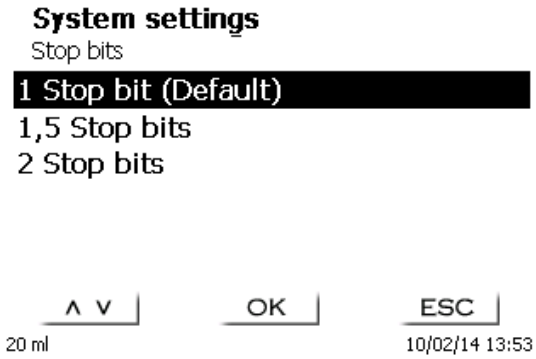

Fig. 144

The RS232-1 can be converted from RS on USB (Fig. 145).

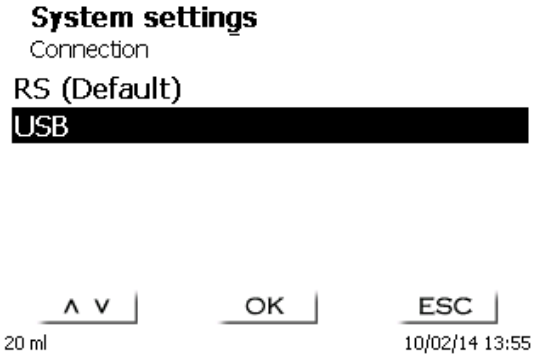

Fig. 145

After switching from RS232 to USB and vice versa, a restart is always necessary (Fig. 146).

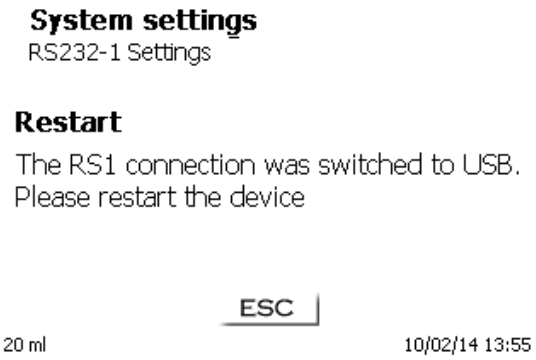

Fig. 146

For the USB connection, a driver must be installed on the PC side.

The driver can be downloaded from the manufacturer website.

5.5 Date and Time

The factory time setting is Central European Time. This setting may be changed, where necessary (Fig. 147).

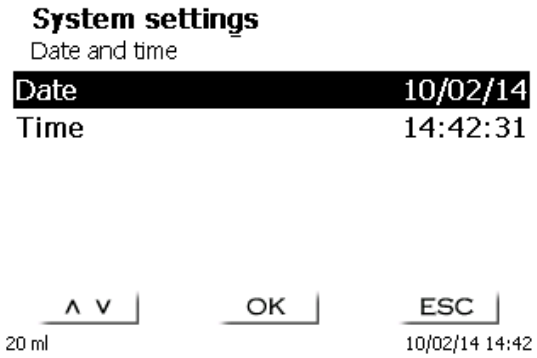

Fig. 147

5.6 RESET

RESET will reset all settings to the factory setting.

All methods will also be deleted! So please print the methods or export/copy them to a connected USB storage medium (this will be possible with a higher update!).

The RESET has to be confirmed separately once again (Fig. 148).

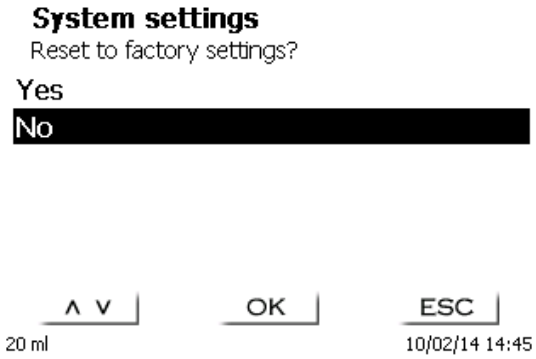

Fig. 148

5.7 Printer

For connecting printers (Fig. 149) please refer to 🕮 **7.3** Printers.

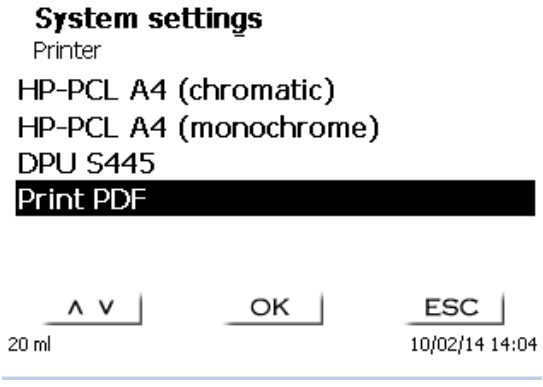

Fig. 149

5.8 Stirrer

Stirrer «**On**» means, that the magnetic stirrer TM 50 can also be used for stirring if now method has been executed. This is the standard setting (Fig. 150).

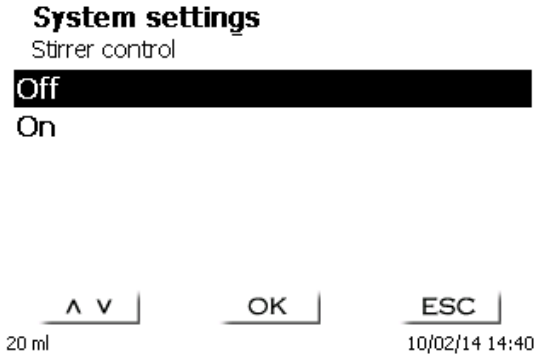

Fig. 150

If the stirrer is set to «**Off**», it is only started if a method is executed.

5.9 Device Information

This point contains information about the device (Fig. 151).

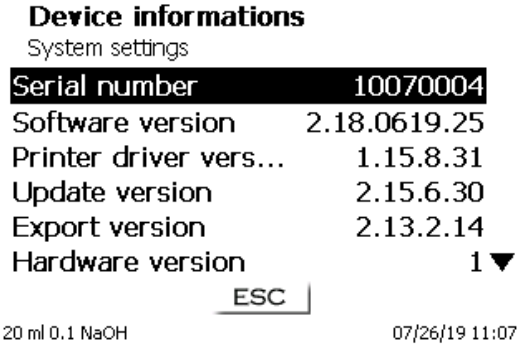

Fig. 151

5.10 System Tones

The system tone (sound) can be set on or off (Fig. 152).

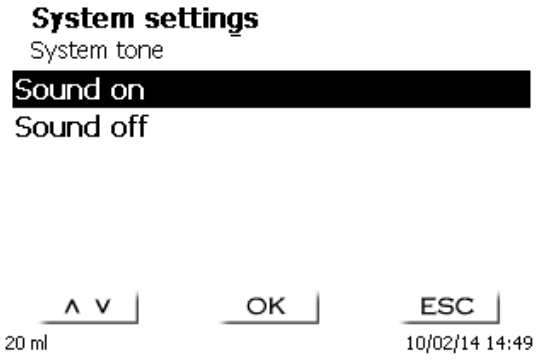

Fig. 152

5.11 Data exchange

All methods with all parameter settings and global memories can be stored and restored on a connected USB-memory. It is also possible to transfer the settings from one titrator to another one. The backup will be started with «**Settings backup**» (Fig. 153).

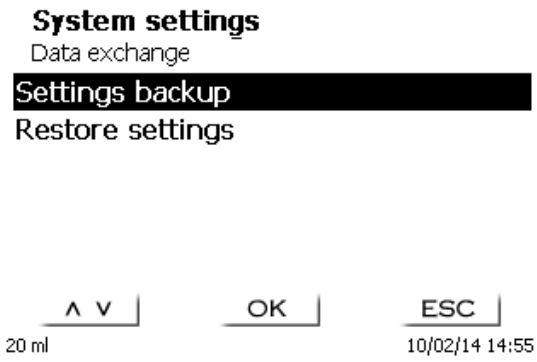

Fig. 153

"Backup settings" is displayed during the backup in blue (Fig. 154).

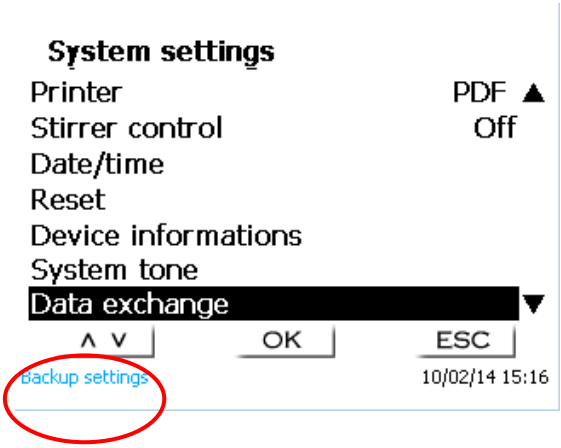

Fig. 154

After a Reset or a maintenance case it is possible to restore the backup with «**Restores settings**» (Fig. 155)

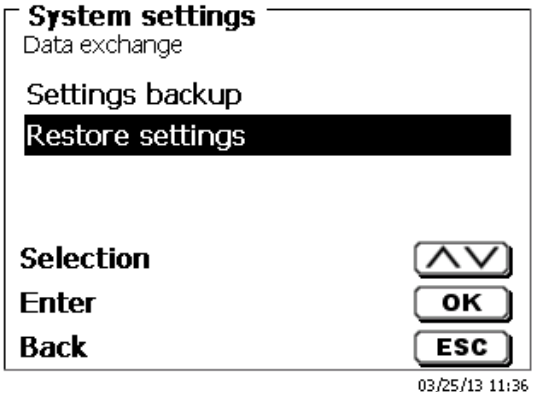

Fig. 155

The backup folder on the USB-memory Stick starts with the backup date (Fig. 156).

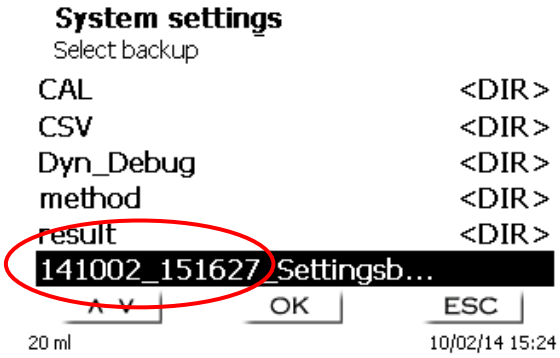

Fig. 156

Confirm the selection with <**ENTER**>/<**OK**>.
“Settings are being restored” is displayed during the restoring process of the backup in blue (Fig. 157).

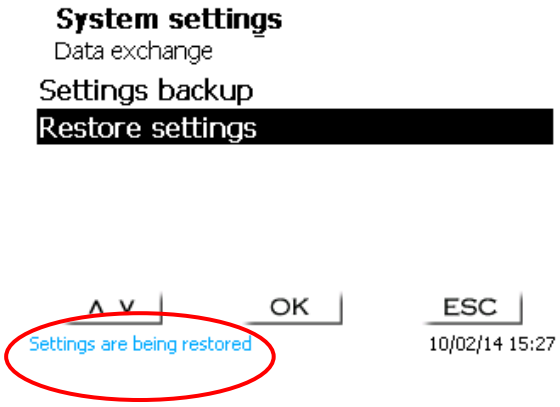

Fig. 157

5.12 Software Update

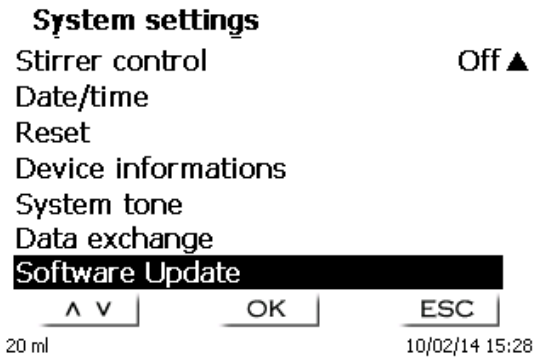

Fig. 158

An update of the device software (Fig. 158) requires a USB stick containing a new version. For this operation, the two files that are needed have to be located in the root directory of the USB device (Fig. 159).

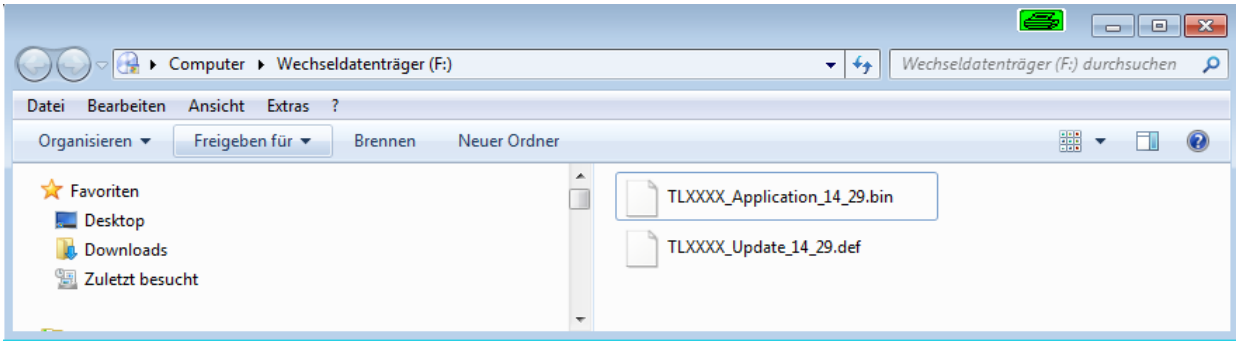

Fig. 159

Plug the USB device into a free USB-A port, wait for some seconds, and then select the Software Update function. The valid software updates will be shown on the display.

In the present case (Fig. 160) this is Version “14_38” from week 38 and year 2014.

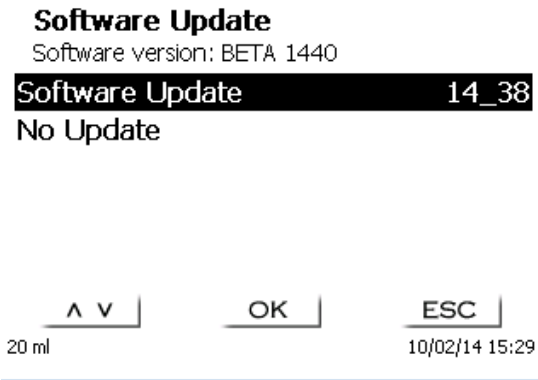

Fig. 160

After starting the update using <**ENTER**>/<**OK**>, next thing to appear is the following graphic (Fig. 161),

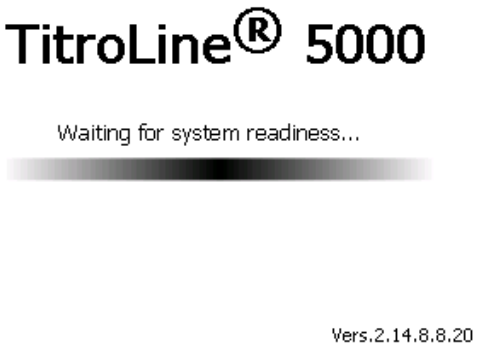

Fig. 161

which will change after a few seconds to the following display (Fig. 162).

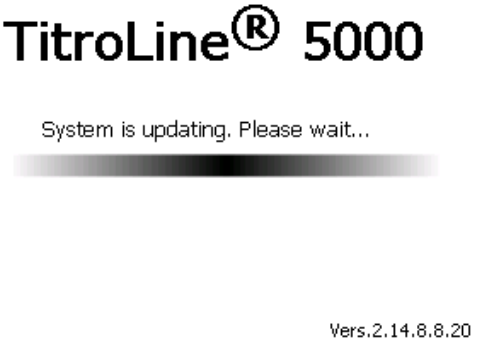

Fig. 162

Upon completion of the update (approx. 4 - 5 minutes), the device will shut down the software completely and proceed to a new start.

In the course of an update, the methods will not be deleted! You can continue to use them.

If no valid update file is stored on the USB stick, a message will appear (Fig. 163)

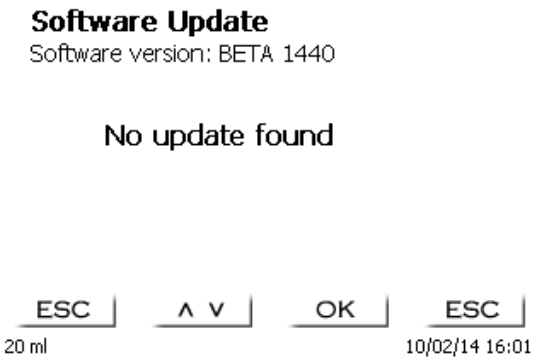

Fig. 163

6 Communication via RS-232 and USB-B interface

6.1 General Information

The TitroLine® 5000 has two serial RS-232-C interfaces to communicate data with other devices. By means of these two interfaces it is possible to operate several devices on one computer (PC) interface. In addition to that, the TitroLine® 5000 also has an alternatively USB-B interface, which can only be used to connect a PC. RS-232-C-1 establishes the connection to a connected computer or to the previous device of the “Daisy Chain”. At the RS-232-C-2 it is possible to connect additional devices (Daisy Chain Concept).

PIN assignment of the RS-232-C interfaces:

PIN No.	Meaning / Description
1	T x D Data output
2	R x D Data input
3	Digital mass

6.2 Chaining multiple devices - “Daisy Chain Concept”

In order to activate several devices in a chain individually, each device must have an own device address. For this it is at first necessary to establish a connection from the computer to the RS-232-C interface 1 of the first devise in the chain by means of a RS-232-C data cable, e.g. Type No. TZ 3097. With the additional RS-232-C data cable, Type No. TZ 3094, the RS-232-C- interface 2 of the first device is connected with the RS-232-C-interface 1 of the second device. At interface 2 of the second device it is possible to connect an additional device.

The TitroLine® 5000 can also be connected via USB cable TZ 3840 (type A (M) - type B (M), 1.8m) to a USB interface of a PC. To accomplish this connection, a driver has to be installed on the PC. Then the USB-B interface takes over the function of the RS232-1 interface.

The address always consists of two characters: e.g. address 1 of the two ASCII- characters <0> and <1>. The addresses can be set from **00** to **15**, i.e. 16 possibilities. It must be ensured that the devices in a chain have different addresses. If a device is addressed with its address, this device will process this command without sending it to another device. The reply to the computer has also an own address. The addresses are allocated as described in 🕮 **5.4** RS-232 Settings.

The TitroLine® 5000 receives commands from a PC at the interface **1** (USB- B) if the computer knows the address. It also sends the answer via this interface. If the address of the incoming command does not match the device address, the complete command will be forwarded to interface **2**. Interface 2 is connected to interface 1 of another device. This device checks the address as well and reacts to the command as the first TitroLine® 5000 did before.

All information (data strings) which arrive at interface 2 of the TitroLine® 5000 will immediately be send to the computer via interface 1 (or USB-B interface). Thus, the computer receives the data of all devices. In practice it is possible to connect up to 16 devices to one computer- (PC-) interface.

6.3 Instruction Set for RS-Communication

The commands consist of three parts:

Adresse, two-digit aa	e.g. **01**
Command	e.g. **DA**
Variable, if necessary	e.g. **14**
an end of command	**<CR> <LF>**

Every command must be completed with the ASCII - sign <CR> and <LF> (Carriage Return and Line Feed). Only if the respective action has ended the answers will be returned to the computer.

Example:
The command to dose 12.5 ml shall be sent to the TitroLine® 5000 with the address 2.
The command consists of the characters:

02DA12.5<CR LF> in detail:

02	=	Device address
DA	=	Dosage command with filling and zero points of the display
12.5	=	Volume in ml to be dosed
<CR LF>	=	Control character as command end

Command	Description	Reply
aaAA	automatic allocation of device address	aaY
aaMC1...XX	choosing a method	aaY
aaBF	“filling burette“. Aufsatz wird gefüllt.	aaY
aaBV	output of dosed volume in ml	aa0.200
aaDA	dose volume without filling, with adding the volume	aaY
aaDB	dose volume without filling, reset of the volume	aaY
aaDO	dose volume with filling, without adding the volume	aaY
aaGF	filling time in seconds (min is 20, default 30)	aaY
aaEX	“exit“ function.back to main menu	aay
aaFP	pH measurement function	aay
aaFT	temperature measurement function	aay
aaFV	mV measurement function	aay
aaGDM	dosing speed in ml/min (0.01 – 100 ml/min)	aaY
aaGF	filling time in sec (adjustable 20 – 999 seconds)	aaY
aaGS	output serial no. Of device	aaGS08154711
aaLC	output of the CAL parameters	
aaLD	output of the measurement data	aaY
aaLR	output report (short report)	aaY
aaM	output of the preset measurement value (pH/mV/ug)	aaM7.000
aaLI	output method content	
aaRH	request of identification	aaIdent: TitroLine® 5000
aaRC	send last command	aa“last command“
aaRS	report status possible answers are: ”STATUS:READY“ for ready ”STATUS:dosing“ dosing ”STATUS:filling“ filling ”ERROR:busy“ if no interchangeable unit has been attached	aaStatus:*“text*
aaSM	start selected method	aaY
aaSEEPROM	EEPROM reset to factory defaults	aaY
aaSR	stop the actual function	aaY
aaSS	titration start with the transfer of the pH end value	aaY
aaVE		Version number of the software aaVersion

7 Connection of Analytical Balances and Printers

7.1 Connection of Analytical Balances

As it often happens that the sample is weighed in on an analytical balance, it makes sense to connect this balance to the TitroLine® 5000. The balance must have a RS-232-C-interface and the connection cable must be configured accordingly. For the following types of balances there are already assembled connection cables:

Balance	**TZ-Number**
Sartorius (all type with 25-pole RS-232), partially Kern	TZ 3092
Mettler, AB-S, AG, PG, Sartorius with USB-Port	TZ 3099
Precisa XT-Serie	TZ 3183
Kern with 9-pole RS-232	TZ 3180

For all other types of balances it is possible to obtain an already assembled connection cable (on demand). For this we need detailed information about the RS-232-C-interface of the balance used.

The connection cable is to be connected to the RS-232-C-interface 2 of the TitroLine® 5000. This side of the connection cables always consists of a 4-pole mini-plug. The other side of the cable can, depending on the type of balance, be a 25-pole plug (Sartorius), a 9-pole plug (Mettler AB-S) or a 15-pole specialised plug (Mettler AT) etc.

In order to allow the balance data to be sent to the TitroLine® 5000, the data transmission parameters of the titrator and the balance must correspond to each other. Additionally, it is necessary to carry out some more standard settings on the side of the balances:

- The balance is to send the balance data via RS-232-C only by means of a print command
- The balance is to send the balance data only after the display standstill
- The balance should never be set to “automatic sending” and/or “send continuously”
- “Handshake” on the balance must be set to “off”, or even “Software Handshake” or “Pause”

No special characters such as **S** or **St** are allowed to be used as prefix in the balance data of the balance data string. In such a case it might be possible that the TitroLine® 5000 cannot process the balance data correctly.

After you have connected the balance with the appropriate cable and have adjusted all settings in the balance software, and possibly in the TitroLine® 5000, you can now test the data transfer of the balance very easily. Start the one method. Confirm the sample designation. Then, the display asks you:

a) to press the print-button at the balance
   → Parameters to “weighted sample automatically”
b) to enter the weighted sample → then the parameters are still set to “weighted sample manually”

Put an object onto the balance and press the print button.
After the standstill of the balance display there will be beep and the transmitted balance data appear:

a) the display changes automatically into the measuring display.
b) the weighted sample must again be confirmed with <**ENTER**>/<**OK**>.

7.2 Balance data editor

Pressing «**F5/balance symbol»** will invoke the so-called balance data editor.
A list with the existing balance data will appear (Fig. 164).

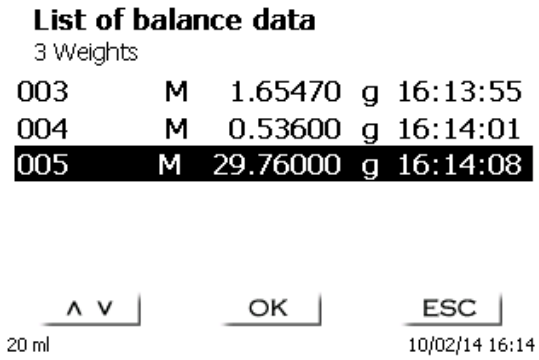

Fig. 164

The balance data can be edited one by one.
Following a change, a star will appear opposite the weighed-in quantity (Fig. 165).

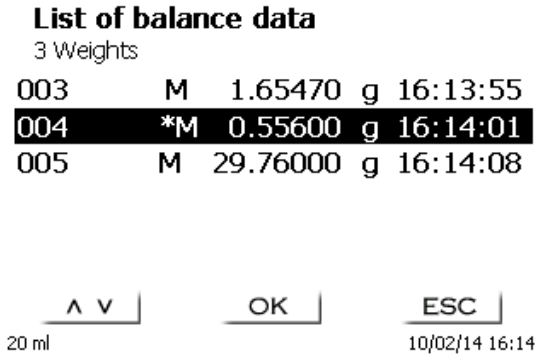

Fig. 165

Weights may be deleted or added individually.
It is also possible to delete all weights at one stroke (Fig. 166).

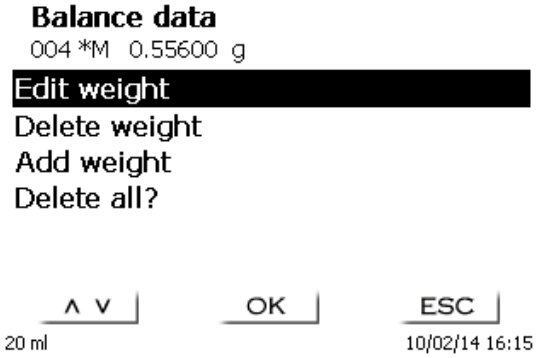

Fig. 166

If no balance data is available, the «No balance data found» message will appear (Fig. 167).

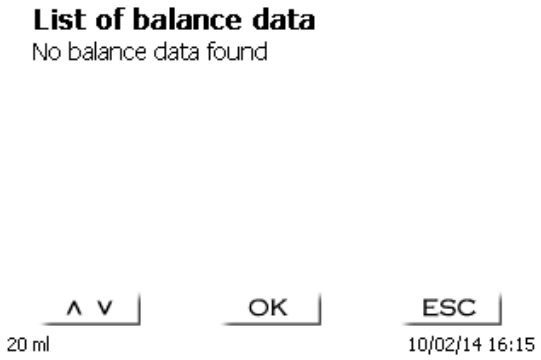

Fig. 167

7.3 Printers

The results, calibration data and methods can be printed on the following media

- HP PCL compatible printer (A4)
- Seiko DPU S445 (Thermo paper 112 mm width)
- On the USB stick in PDF- and CSV-format

To connect the printers to the burette please use the USB socket.

When printing, please check whether the correct printer is connected. It is not possible to print “HP” printer layouts on another thermal printer or vice versa. The printer settings should always be checked and adjusted after changing the printer (Fig. 168).

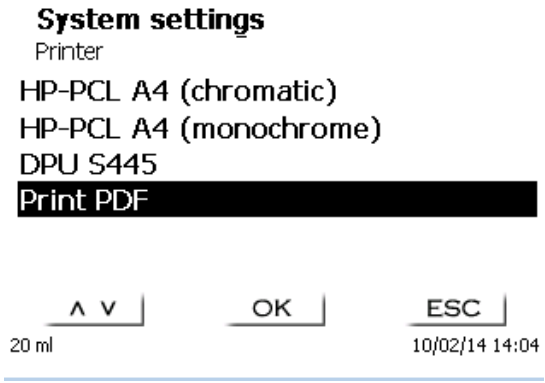

Fig. 168

Only one printer should be connected for one titrator because automatic printer recognition is not activated. «**Print PDF**» is the default setting.

8 Maintenance and Care of the Titrator

⚠ The preservation of the proper functioning of the device requires testing and maintenance work to be performed on a regular basis. Regular inspections are essential prerequisites for the correctness of the volume and the proper functioning.

The accuracy of the volume is determined by all chemicals-carrying components (piston, cylinder, valve, titration tip and hoses). These parts are subject to wear and tear. The piston and cylinder are subject to particular strain, hence they require special attention.

Heavy strain:
Use of e.g. concentrated solutions, reagents and chemicals (> 0.5 mol/L); chemicals attacking glass, such as fluorides, phosphates, alkali solutions; solutions with a tendency to crystallising out; Fe (III) chloride solutions; oxidising and corroding solutions such as iodine, potassium permanganate, Cer (III), Karl-Fischer titration agent, HCl; solutions with a viscosity of > 5 mm^2/s; frequent, or even daily use.

Normal strain:
Use of solutions, reagents and chemicals (up to 0.5 mol/l) which do not attack glass, crystalize out or corrode.

Interrupted use:
If the dosing system is not in use for more than two weeks, we recommend emptying and cleaning the dosing unit [6]. This applies in particular under the operating conditions referred to in the „Heavy strain" section. If this recommendation is not adhered to, the piston of the valve may become leaking, this may result in damage to the piston burette.

⚠ If the liquid is left within the system, you will also have to reckon with corrosion and an alteration of the solutions used over time, which includes e.g. crystalisation. Considering that as of the state of the art there are no plastic hoses available for the use in titration equipment which would be perfectly free of diffusion phenomena, particular attention is to be paid to the range of the hose lines.

We recommend the following inspection and maintenance work:	**Heavy strain**	**Normal strain**
Simple cleaning: • Wiping off splashed chemicals from the outer surface [1]	Whenever required in operation	Whenever required in operation
Sight check: • Check for leakage in the area of the dosing system. [2] • Is the piston tight? [3] • Is the valve tight? [4] • Titration to clear? [5]	Weekly, when putting back into operation	Monthly, when putting back into operation
Basic cleaning of the dosing system: • All parts of the dosing system to be cleaned separately. [6]	Every three months	Whenever necessary
Technical inspection: • Check for air bubbles in the dosing system. [7] • Visual inspection • Check of the electrical connections. [8]	Semi-annually, when putting back into operation	Semi-annually, when putting back into operation
Verification of the volume according to ISO 8655 • Perform basic cleaning • Inspection according to ISO 8655 Part 6 or Part 7. [9]	Semi-annually	Annually

ℹ Depending on the respective application, there may be different specifications for the entirety of the inspection and maintenance work to be performed. The individual intervals may be extended if no complaints occur, but they will have to be shortened again as soon as any problem has arisen

The inspection of the metrological reliability including maintenance work is offered as a service (including a manufacturer's certificate, if so ordered). In this case the titration device is to be sent in. Please contact the service (see backside of this manual).

Detailed description of the inspection and maintenance work

[1] Wipe off using a soft cloth (and some water with a normal household detergent).
[2] Leaking connections can be identified by moisture or crystals at the threaded connections of the hoses, at the sealing lips of the piston inside the dosing cylinder or at the valve.
[3] If any liquid becomes visible below the first sealing lip, it has to be checked at short timely intervals whether any liquid will build up under the second sealing lip, too. In this case both the piston and the glass cylinder have to be replaced immediately. It is easily possible that in operation small liquid droplets build up under the first sealing lip, but they may also disappear again. This phenomenon alone is no reason for replacement.
[4] The valve has to be removed from its housing for inspection. In this process, the hoses remain connected to the valve. Please check for moisture underneath the valve. When reinserting the valve, please make sure that the small cam at the rotating axis is fitted into the corresponding groove again.
[5] The titration tip must be free of sedimentation or crystals which might obstruct the dosing process or falsify the results.
[6] Remove the cylinder, take the valve out of the valve housing, unscrew the hoses and then rinse all parts carefully with distilled water. For the assembly of the cylinder, hoses and other parts of the interchangeable unit, please refer to the operating instructions.
[7] Dose one burette volume, then refill. Air bubbles will gather at the tip of the cylinder and in the titration hose where they can be detected easily. If bubbles become visible, please re-tighten all connections finger tight, and then repeat dosing. If air bubbles still remain within the system, [6] please check the valve and replace the hose connections. The air bubbles may also occur at the interface between the sealing lip of the piston and the cylinder. If a reduction of the filling speed will not do, the dosing unit has to be replaced.
[8] Check the electrical plug contacts for corrosion and mechanical damage. Defective parts have to be repaired or replaced by new parts.
[9] Please refer to the application “Burette inspection according to ISO 8655 Part 6”.

9 Guarantee

We provide guarantee for the device described for two years from the date of purchase. This guarantee covers manufacturing faults being discovered within the mentioned period of two years. Claim under guarantee covers only the restoration of functionality, not any further claim for damages or financial loss. Improper handling/use or illegitimate opening of the device results in loss of the guarantee rights. The guarantee does not cover wear parts, as lobes, cylinders, valves and pipes including the thread connections and the titration tips. The breach of glass parts is also excluded. To ascertain the guarantee liability, please return the instrument and proof of purchase together with the date of purchase freight paid or prepaid.

10 Storage and transportation

If the TitroLine® 5000 or the interchangeable units have to be stored over some time, or to be dislocated, the use of the original packing will be the best protection of the devices. However, in many cases this packing will not be available anymore, so that one will have to compose an equivalent packaging system. Sealing the lower section in a foil is hereby recommended. The devices should be stored in a room with a temperature between + 10 and + 40 °C, and the (relative) humidity of the air should not exceed 70 %.

⚠ If the interchangeable have to be stored over some time, or to be dislocated, the fluids inside the system, especially aggressive solution have to be removed.

11 Recycling and Disposal

Please observe the applicable local or national regulations concerning the disposal of “waste electrical and electronic equipment”.

The TitroLine® 5000 and his packaging are manufactured as far as possible from materials which can be disposed of environmental-friendly and recycled in a technically appropriate manner. If you have any question regarding disposal, please contact the service (see backside of this manual).

ℹ The main printed board carries a lithium battery (type CR 2430). Batteries should not to be disposed of with the normal domestic waste. They will be taken back and recycled or disposed of properly by the manufacturer at no cost.

SI Analytics®

EG - KONFORMITÄTSERKLÄRUNG
EC - DECLARATION OF CONFORMITY
CE - DÉCLARATION DE CONFORMITÉ
CEE - DECLARATIÓN DE CONFORMIDAD

Wir erklären in alleiniger Verantwortung, dass das folgende Produkt	We declare under our sole responsibility that the following product	Nous déclarons sous notre seule responsabilité que le produit ci-dessous	Declaramos bajo nuestra única responsabilidad, que el producto listado a continuación
Titrator	**Titration unit**	**Titrateur**	**Titulador**
TitroLine® 5000			
auf das sich diese Erklärung bezieht, übereinstimmt mit den folgenden EG Richtlinien.	to which this declaration relates are in conformity with the following EC directives.	auxquels se réfère cette déclaration est conforme directives CE soul vantes	todo lo relativo a esta declaración está en conformidad con las directivas CEE siguientes
EMV EG-Richtlinie 2014/30/EU Sicherheit EG Richtlinie 2014/35/EU RoHS EG Richtlinie 2011/65/EU	EMC EC-Directive 2014/30/EU Safety EC-Directive 2014/35/EU RoHS EC-Directive 2011/65/EU	CEM CE-Directive 2014/30/EU Sécurité CE-Directive 2014/35/EU RoHS CE-Directive 2011/65/EU	CEM CEE siguientes 2014/30/EU Seguridad CEE siguientes 2014/35/EU RoHS CEE siguientes 2011/65/EU
Harmonisierte Normen oder normative Dokumente	Harmonized standards or normative documents	Normes harmonisées ou documents normatifs	Estándares armonizados o documentos normativos
EMV EN 61326-1:2013 Sicherheit EN 61010-1 :2010 RoHS EN 50581: 2012	EMC EN 61326-1:2013 Safety EN 61010-1 :2010 RoHS EN 50581: 2012	CEM EN 61326-1:2013 Sécurité EN 61010-1 :2010 RoHS EN 50581: 2012	CEM EN 61326-1:2013 Seguridad EN 61010-1 :2010 RoHS EN 50581: 2012

Mainz den 21.07.2017

Dr. Robert Reining
Geschäftsführer, Managing Director

Konf. No.: Titrat 020c

Xylem Analytics Germany GmbH
Dr.-Karl-Slevogt-Str. 1
82362 Weilheim
Deutschland, Germany, Allemagne, Alemania

Typ / type / type / tipo **TitroLine® 5000**

Bescheinigung des Herstellers

Wir bestätigen, dass oben genanntes Gerät gemäß DIN EN ISO 9001, Absatz 8.2.4 „Überwachung und Messung des Produkts“ geprüft wurde und dass die festgelegten Qualitätsanforderungen an das Produkt erfüllt werden.

Supplier’s Certificate

We certify that the above equipment has been tested in accordance with DIN EN ISO 9001, Part 8.2.4 “Monitoring and measurement of product” and that the specified quality requirements for the product have been met.

Certificat du fournisseur

Nous certifions que le produit a été vérifié selon DIN EN ISO 9001, partie 8.2.4 «Surveillance et mesure du produit» et que les exigences spécifiées pour le produit sont respectées.

Certificado del fabricante

Certificamos que el aparato arriba mencionado ha sido controlado de acuerdo con la norma DIN EN ISO 9001, sección 8.2.4 «Seguimiento y medición del producto» y que cumple con los requisitos de calidad fijados para el mismo.

SI Analytics

a xylem brand

Hersteller
(Manufacturer)
Xylem Analytics Germany GmbH
Dr.-Karl-Slevogt-Str.1
82362 Weilheim
Germany

SI Analytics
Tel. +49(0)6131.66.5111
Fax. +49(0)6131.66.5001
E-Mail: si-analytics@xyleminc.com
www.XylemAnalytics.com

Service und Rücksendungen
(Service and Returns)
Xylem Analytics Germany Sales GmbH & Co.KG
SI Analytics

Gebäude G12, Tor Rheinallee 145
55122 Mainz
Deutschland, Germany

Tel. +49(0)6131.66.5042
Fax. +49(0)6131.66.5105
E-Mail: Service-Instruments.si-analytics@xyleminc.com