OPERATING MANUAL

TitroLine® 7800

TITRATOR

SI Analytics

a xylem brand

Wichtige Hinweise:

Die Gebrauchsanleitung ist Bestandteil des Gerätes. Vor der ersten Inbetriebnahme bitte sorgfältig lesen, beachten und anschließend aufbewahren. Aus Sicherheitsgründen darf das Gerät 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 der verschiedenen Länder zu berücksichtigen, Ergänzungen an dem Gerät vorgenommen werden, ohne dass die beschriebenen Eigenschaften beeinflusst werden.

Important notes:

The operating manual is part of the product. Before initial operation of the unit, please carefully read and observe the operating instructions and keep it. For safety reasons the unit may only be used for the purposes described in these present operating instructions. Please also observe the operating instructions for the units 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 unit without changing the described properties.

Instructions importantes:

Le manuel d'utilisation fait partie du produit. Prière de lire et d’observer attentivement le mode d'emploi avant la première mise en marche de l´appareil, et de le conserver. Pour des raisons de sécurité, l´appareil 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 l´appareil pour séries de dilution qui n’influencent pas les caractéristiques décrits.

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

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Version 170127 **US**

Notes to the Manual

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

The pictogram ⚠ has the following meaning:

- Warning of a general danger to personnel and equipment.
- Non-compliance results (can result) in injury or material damage.

ℹ Important information for device use.
🕮 Refers to another part of the operating manual.

Status at time of printing
Advanced technology and the high quality of our products are guaranteed by a continuous development. This may result in differences between this operating manual and your product. We cannot exclude mistakes. We are sure you understand that no legal claims can be derived from the information, illustrations and descriptions.
A potentially more recent version of this manual is available on our internet website at www.si-analytics.com. The German version is the original version and binding in all specifications.

1 Technical Specifications of the Titrator TitroLine® 7800

1.1 Intended Use

The TitroLine® 7800 is a potentiometric-/volumetric-/KF- titrator and suitable for the following applications:

pH-,
mV-,
LF
µA-,
volumetric- KF-
and Dead-stop-

titrations with a maximum of 50 memorisable methods.

The examples of possible use of the Titrators TitroLine® 7800 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. calcium, fluoride, copper, lead ions
- Indices such as OH number, iodine number, and saponification number
- Auslesen und Abspeichern der Kalibrierdaten von SI Analytics ID Elektroden
- Titration up to two inflection points examined as the titration of calcium and magnesium
- pH-stat titrations
- Non-aqueous potentiometric titrations such as TAN and
- Pre-dosing with a connected piston burette
- Connection and use of an autosampler TW alpha plus/TW 7400
- KF titrations with 1-component KF reagents
- KF titrations with 2-component KF reagents
- Dead stop titrations such a bromine number and sulphur dioxide in
- Connection of intelligent digital sensors (IDS) such as pH or conductivity electrodes on the second digital measuring input.
- Parallel recording of two measuring parameters
- Compatibility with TitriSoft from Version 3.15

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

In addition, the TitroLine® 7800 comes with the functionalities of the TITRONIC® 500 piston burette:

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

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.

⚠ **General provisions:**

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.

1.2 Specifications

1.2.1 Titrator TitroLine® 7800

Translation of the legally binding German version (Release: 26. January 2016)

CE sign: CE

EMC compatibility according to the Council Directive: 2004/108/EG;
applied harmonized standards: EN 61326-1:2006
Low-voltage directive according to the Council Directive 2006/95/EG
Testing basis EN 61 010, Part 1

Contry 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® 7800 titrator to “warm up”.

Measuring input 1: (analog)

pH/mV-input with 24 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
adjustable damping settings of the pH/mV measuring signal
RFID receiver for SI Analytics ID electrodes

		Measurement range	Over range	Display resolution	Measurement accuracy* without sensor probe	Input resistance [Ω]
pH	pH	- 3.0 ... 18.00	- 3.1 … 18.00	0.001	0.002 ± 1 Digit	$> 1 \cdot 10^{13}$
mV	U [mV]	- 2000 ... 2000	- 2020 ... 2020	0.1	0.10 ± 1 Digit	$> 1 \cdot 10^{13}$

- Measurement input: 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	- 75 ... 195	0.1	0.2 K ± 1 Digit
NTC 30	- 40 ... 0	0.1	1.0 K ± 1 Digit
	0 ... 125	0.1	0.3 K ± 1 Digit

- Measurement input: Karl Fischer (Dead-stop) connector (µA) for double platinum electrode
  Polarisation voltage variably adjustable from 40 … 220 mV
  Connector: 2 x 4 mm - sockets

Measurement range I [µA]	Display resolution	Measurement accuracy* without sensor probe
100	0.1	-5 /+ 3 µA ± 1 Digit
50	0.1	+/- 3 µA ± 1 Digit
10	0.1	+/- 1 µA ± 1 Digit
5	0.1	+/- 0,2 µA ± 1 Digit

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

Measuring input 2 (IDS®): Measurement input connector for intelligent digital sensors

	Measurement range	Display resolution	Measurement accuracy* without sensor probe
pH	depending on sensor type	0.001	depending on sensor type
mV	depending on sensor type	0.1	depending on sensor type
T [°C]	depending on sensor type	0.1	depending on sensor type
conductivity	depending on sensor type	0.1	depending on sensor type

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):
pH/mV-input with electrode socket according DIN 19 262/or BNC
- *Measurement input* µA:
(Dead-Stop-) connector for double platinum electrode (Connection sockets: 2 x 4 mm)
- *Measurement input* Pt 1000:
Temperature sensor probe for resistance thermometer Pt 1000
(Connection sockets: 2 x 4 mm)
- *Measurement input* 2 (IDS®):
Digital input for connector for intelligent digital sensors (pH, mV, LF…)

Power supply: power supply 90-240 V; 50/60 Hz, power input: 30 VA

⚠ Use the power supply TZ 1853 (Type No.: FW 7362M/12) only!

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® 7800
- TW alpha plus, TW 7400
- Burettes TITRONIC® 500, TITRONIC® 110 *plus,* TITRONIC® *universal*,
- Balances of the types Mettler, Sartorius, Kern, Ohaus,(for more, please contact us)
- Exit Daisy Chain

USB Interface:
2 x USB-type-A und 1 x USB-type-B

USB –type B („slave“) for connecting a PC
USB –type A („master“) for connecting:
- USB keyboard
- USB printer
- USB manual controller
- USB data media e.g. USB stick
- USB Hub

Ethernet Interface:
for connecting a local network (LAN)

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

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

Housing:

Material:	Polypropylene
Front keyboard:	polyester coated
Dimensions:	15.3 x 45 x 29.6 cm (W x H x D), height incl. interchangeable unit
Weight:	ca. 2.3 kg for basic unit ca. 3.5 kg for complete device incl. interchangeable unit (with empty reagent bottle)

Ambient conditions: 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

Interchangeable units:

Compatibility:	units are compatible to the: - the titrators TitroLine® 6000 / 7000 / 7500KF / 7750 / 7800 - the Piston Burette TITRONIC® 500
Recognition:	automatically through RFID Recognition of unit size and characteristics of the Titration- or dosing solution
Valve:	volume neutral cone valve made from fluorocarbon polymers (PTFE), TZ 3000
Cylinder:	borosilicate glass 3.3 (DURAN®)
Hoses:	FEP hose set, blue
Bracket for supply bottle:	suitable for square glass bottle and misc. reagent bottles
Materials:	borosilicate glass DURAN®, fluorocarbon polymers (PTFE), stainless steel, polypropylene
Dimensions:	15 x 34 x 22.8 cm (W x H x D) incl. reagent bottle
Weight:	approx. 1.2 kg for interchangeable unit WA incl. empty reagent bottle

Dosing accuracy: after DIN EN ISO 8655, part 3:
Accuracy: 0.15 %
Precision: 0.05 - 0.07 %
(in dependence of the used interchangeable unit)

Dosing accuracy of the Titrator TitroLine® 7800 with WA interchangeable units

Interchangeable. unit type No.	Volumen [ml]	Tolerances of the $Ø_i$ of the glass cylinder [mm]	Dosage error according to 100 % volume [%]	Reproducibility [%]
WA 05	5.00	± 0.005	± 0.15	0.07
WA 10	10.00	± 0.005	± 0.15	0.05
WA 20	20.00	± 0.005	± 0.15	0.05
WA 50	50.00	± 0.005	± 0.15	0.05

1.2.2 Titrationstand TM 235 KF

Translation of the legally binding German version (Release: 26. January 2016)

In connection with the titrator TitroLine® 7800

CE sign: CE
MC compatibility according to the Council Directive: 2004/108/EG;
applied harmonized standards: EN 61326-1:2006
Low-voltage directive according to the Council Directive 2006/95/EG
Testing basis EN 61 010, Part 1

Country of origin: Germany, Made in Germany

Pump:

Free volume flow- air-:	flow rate 2.25 l / min
Delivery pressure max.	1.5 bar
Flow rate liquid medium	ca. 0.8 l / min

Stirring speed: 50 ... 1000 U/min

Hoses: PVC- hose (outer diameter 6 x 1 mm)
PTFE- hose (outer diameter 4 x 0.5 mm)

Connections

Power supply: Low voltage input 12 V / ⎓ on the backside of titration stand
Plug connection: plug for low voltage connection – phone jack-,
Positive pole at pin contact, inside contact ∅ = 2.1 mm, USA/Japan,
Power supply via titrator TitroLine® 7800

⚠ Use the Power supply TZ 1855, Type No.: FW 7555O/12 only!

Housing:

Material:	Polypropylene
Front keyboard:	polyester coated
Dimensions:	80 x 130 x 250 mm (W x H x D), height without stand
Weight:	1.0 kg

Ambient conditions: 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

⚠ Do not used in hazardous locations!

1.3 Warning and safety information

The TitroLine® 7800 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 titrator Titrator TitroLine® 7800 und the power supply TZ 1853 must be opened by authorised persons only; this means, for instance, that work on electrical equipment must only be performed by qualified specialists.**In the 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 titrator and 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 titrator has to be put out of operation and secured against inadvertent putting to operation.** In this case please switch the titrator off, pull plug of the mains cable out of the power supply, and remove the titrator from the place of work.

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

- if the package is damaged,
- if the titrator TitroLine® 7800 shows visible damages,
- if the power supply TZ 1853 shows visible damages,
- if the titrator TitroLine® 7800 does not function properly,
- if liquid has penetrated into the casing,
- if the titrator TitroLine® 7800 has been altered technologically or if unauthorized personnel tried or succeeded to open the instrument as attempt to repair it.

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

⚠ The titrator TitroLine® 7800 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. It has to be ensured on the side of the user that the persons entrusted with the use of the titrator TitroLine® 7800 are experts in the handling of substances used in the environment and in titrator or that they are supervised by specialised persons, respectively.

⚠ During all work with titration solutions: **Please wear protective glasses!**

The titrator TitroLine® 7800 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 TitroLine® 7800 have to be considered (please also refer to 🕮 **chapter 1.1**).

For the use of liquids with high vapour pressure or (mixture of) substances not being mentioned in 🕮 **chapter 1.1** as allowed substances, the safe and proper operation of the titrator TitroLine® 7800 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 (please refer also to 🕮 **chapter 8** "Maintenance and Care of the titrator").

2 Unpacking and First Operation

2.1 Unpacking and First Operation of the titrator

The titrator TitroLine® 7800 has been put together especially for you (basic unit + corresponding modules and accessories). For this reason, there may be differences with respect to the delivery and the accessories described in this chapter. (For any questions please contact us directly) The scope of delivery, please refer to the attached packing list.

The titrator 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 titrator TitroLine® 7800 may be placed on any flat surface.

Scope of delivery:

a) Titrator TitroLine® 7800 (basic unit)

- TitroLine® 7800
- Keyboard TZ 3835
- Power supply TZ 1853 (100V … 240V) with some primary adapter
- Manual keypad TZ 3880
- Connection cable for stirrer/pump (TZ 1577)
- Stand rod TZ 1510 (10 mm x 370 mm)
- Piston extraction tool (TZ 3813)
- Electrode holder Z 305
- Stop pin for titration clamp Z 304

b) TitroLine® 7800 with KF accessories

- TitroLine® 7800 basic unit (see above)
- Exchangeable head WA 05, WA 10 or WA 20
- The KF titration stand (pump and stirrer) TM 235 KF with waste- (1 L clear glass), solvent (1 L amber glass) and bottle for the desiccant (100 ml) and with all PTFE and PVC hoses.
- Titration vessel TZ 1770 incl. Titration tip TZ 3285 (KF micro valve)
- KF starter kit TZ 1789 with desiccant (molecular sieve), glass wool und a set of syringes and needles.
- Electrode KF 1100

2.2 Back panel of the titrator TitroLine® 7800

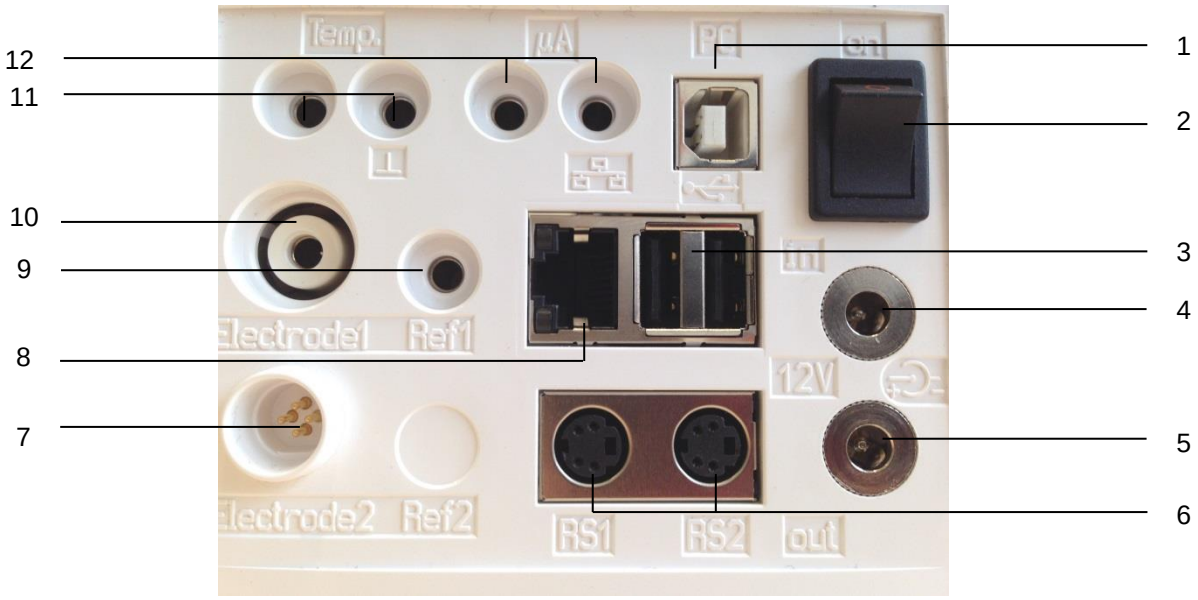

Fig. 1

The TitroLine® 7800 is equipped with the following connections:

1) USB-B interface for connection to a PC
2) On/Off switch
3) Two USB-A (“Master“) interfaces for connecting USB devices such as a keyboard, printer, manual control unit, USB memory device etc.
4) Socket ”in“: Connection of the external power supply TZ 1853
5) Socket “out“: Connection of the TM 235 / TM 235 KF magnetic stirrer
6) Two RS232 ports, 4-channel (Mini-DIN):
   RS1 for connection to the PC
   RS2 for connection of a weighing balance and other devices from SI Analytics (burettes etc.)
7) Measurement input 2 for intelligent digital sensors (IDS®) e.g. pH, mV, LF
8) Ethernet Interface (LAN)
9) Measurement input for reference electrodes (Ref.)
10) Measurement input 1 (DIN or BNC through adapter) for the connection of pH, redox and other measurement or combination electrodes.
    Connection of SI Analytics ID electrodes to TitroLine® 7800 see 🕮 **chapter 2.4.6**
11) Temperature measurement input for connecting Pt 1000 electrodes
12) µA measurement input for the connection of double platinum electrodes

2.3 Connection and installation of titrator and magnetic stirrer TM 235 / TM 235 KF

The low voltage cable of the power supply TZ 1853 has to be plugged in to the 12 V socket „in“, (see Fig. 1 back panel, 🕮 **chapter. 2.2**), on the back panel of the titrator. Then plug the power supply into the plug socket.

Fig. 2

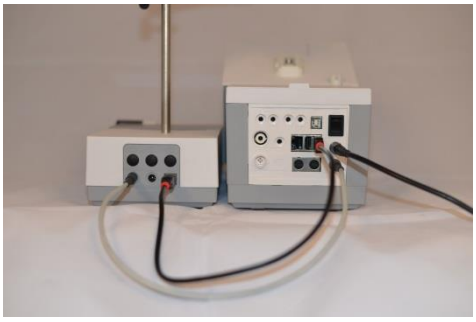

Fig. 3

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

As a rule, the TM 235/ TM 235 magnetic stirrer is arranged to the right of the titrator. The magnetic stirrer is connected to the 12V out-socket in the rear panel of the piston burette using the TZ 1577 connection cable (scope of delivery of the basic device), see Fig. 1 back panel, 🕮 **chapter. 2.2**. The stand rod (scope of delivery of the basic device) is screwed into the thread; subsequently the Z 305 titration clamp (scope of delivery of the basic unit) is installed (fig. 3).

2.4 Installing the Z 300 Rod Foot Plate (Optional)

If the TM 235/TM 235 KF magnetic stirrer is not in use, it is recommended to use the Z 300 rod foot plate. The Z 300 rod foot plate is made of solid metal (fig. 4). The bottom of the device contains a recess which is precisely worked to accommodate the metal foot plate. The metal foot plate itself features one thread on both sides (top and bottom) to hold the stand rod (coming with the basic device). This means that the metal foot plate can be used both to the left and to the right of the device, depending on the specific needs. The basic device is to be placed on the metal foot plate; subsequently the stand rod is screwed into the thread. Now it is possible to install the Z 305 titration clamp (included with the basic device) on the stand rod (fig. 5).

Fig. 4

Fig. 5

2.5 Setting the Language of the Country

The ex-factory default language setting is English.
When the piston burette is switched on, the main menu will appear once the boot sequence is completed.

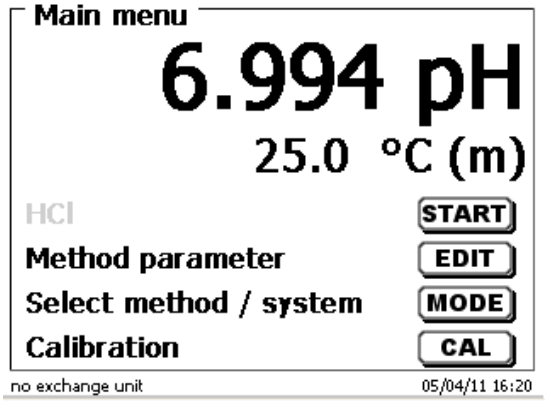

Fig. 6

Using <**SYS**/<**F7**> or <**MODE**>, you navigate to the system settings.
The very first menu is to be used for setting the language of the country.

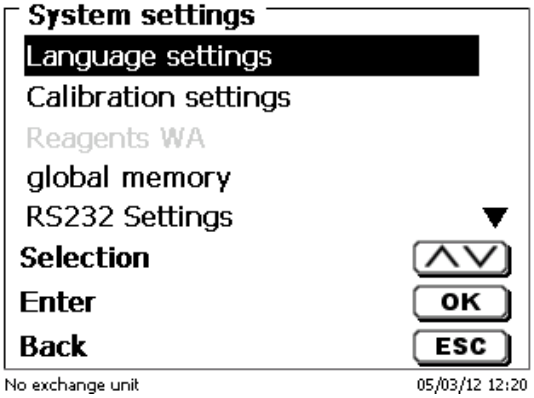

Fig. 7

Use <**ENTER**>/<**OK**> to call the menu.
Select the national language using the <↑↓> arrow keys, confirm it with <**ENTER**>/<**OK**>:

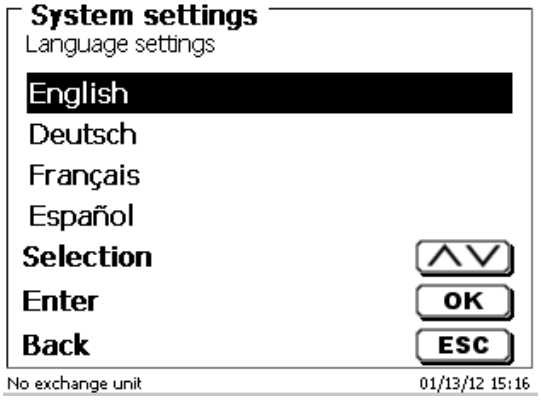

Fig. 8

The selected language will appear immediately.
Pressing the <**ESC**> key twice will return the user to the main menu.

2.6 Installation and Connection of the TM 235 KF titration stand and titration vessel

As a rule, the TM 235 KF titration stand is arranged to the right of the titrator.

The pump/stirrer is connected to the 12V out-socket at the rear panel of the TitroLine® 7800 using the TZ 1577 connection cable (scope of delivery of the basic device) (see Fig. 1 back panel, 🕮 **chapter. 2.2**).

The stand rod (scope of delivery of the basic device) is screwed into the thread of the TM 235 KF.

The titration vessel TZ 1770 is mounted at the stand rod.
Please take care that the metal clamp is adjusted as shown in the attached.

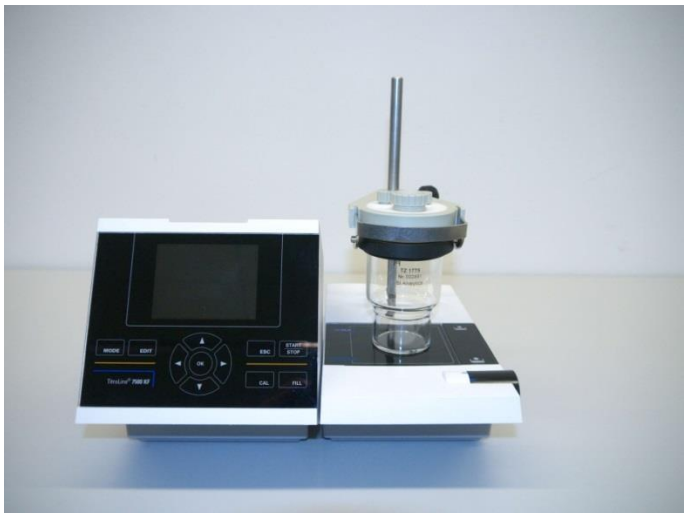

Fig. 9

Put all three white inner plastic adapters at the waste, solvent and moisture bottle.

Fill the moisture bottle with molecular sieve.
Connect the PVC and PTFE plastic tubes as shown in the next pictures (Fig. 10-14).

The PVC tubes are connected to the connectors at the back side of the TM 235 KF.
The long PVC tube is used for the connection of the waste bottle.
The two shorter PVC ones are used to connect the moisture bottle and the solvent bottle.

Fig. 10

The moisture bottle is connected to the right connector (view from above) of the TM 235 KF.
The waste (clear) bottle is connected to the left connector.

Fig. 11

The PTFE tube from the clear waste bottle is adjusted to the ground (tube 1) of the titration vessel.

The PTFE tube from the solvent bottle (tube 2) is adjusted as shown in Fig 12 and 13.

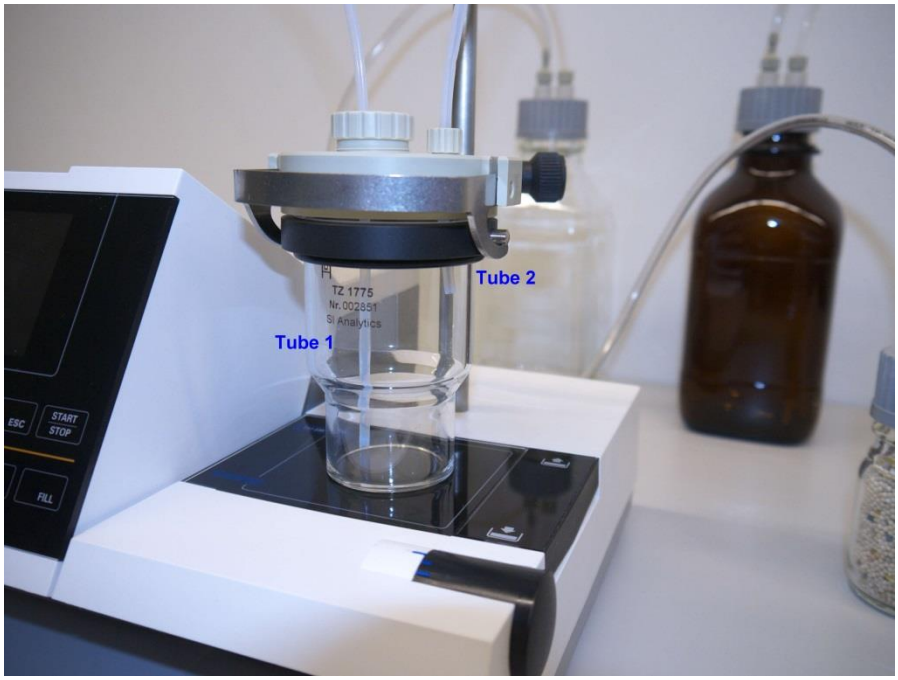

Fig. 12

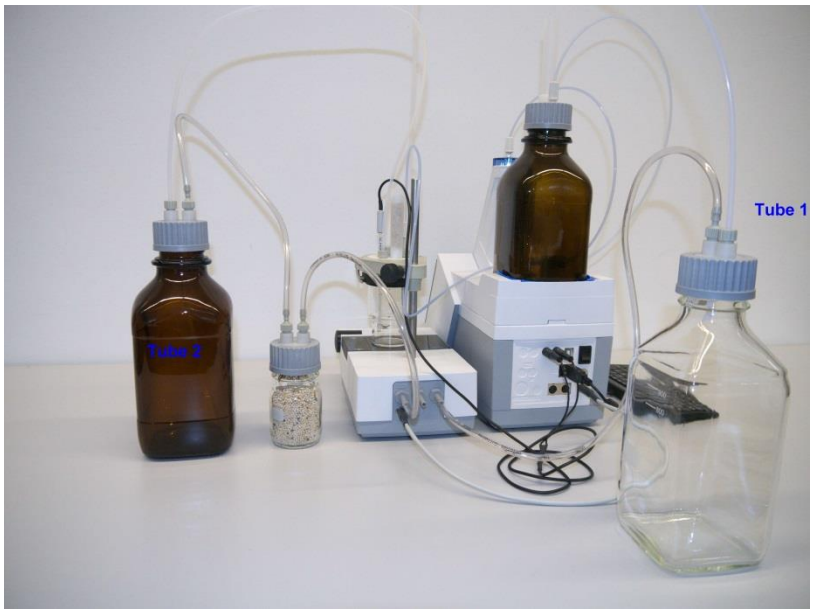

Fig. 13

The burette tip is placed into the left NS 14 opening and connected to the valve of the interchangeable unit.

Put first some glass wool and then molecular sieve in the plastic moisture tube. Place it to the other NS 14 opening as shown in the next picture.

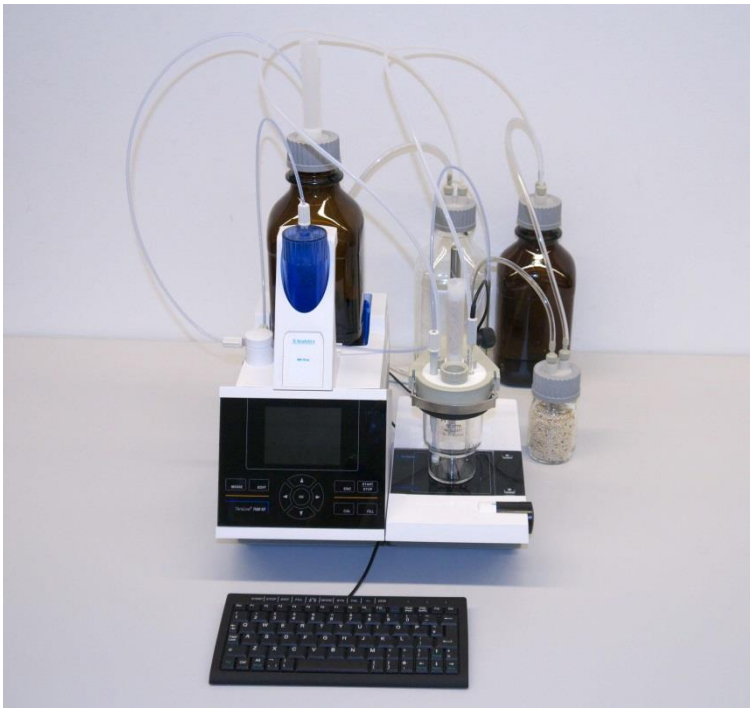

Fig. 14

The electrode KF 1100 is placed into the NS 7.5 opening and connected to the µA input of the TitroLine® 7800.

The keyboard is connected to one of the USB-A ports.

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

2.7 Exchangeable head (WA)

Fig. 15

1) TZ 2003 - drying tube
2) TZ 3802 - threaded cap with borehole GL 45, incl. adapter with 2 openings for drying tube and suction hose
3) TZ 3873 - dosing hose without dosing tip and holding bracket, or
   TZ 3874 - dosing hose with dosing tip and holding bracket
4) TZ 3803 - 1 litre reagent bottle, brown
5) TZ 3900 - UV protection, blue transparent
6) TZ 1507 - plastic drip-down tubule
7) TZ 3000 - 3/2-way valve
8) TZ 3801 - valve cover lid
9) TZ 3872 - connection hose
10) TZ 3871 - suction hose

2.7.1 Installing the interchangeable unit

Fig. 15 shows a completely assembled interchangeable unit.

1. Remove the valve with the attached hoses from the pack and push it on the valve support until it snaps in position. Slip on the valve cover lid on the valve as is shown in Fig. 15.
2. Insert the TZ 3872 connection hose in the threaded hole provided in the burette cylinder and tighten it manually.
3. Insert the TZ 3871 suction hose into the threaded opening of the GL 45 or S 40 adapters and tighten it manually.
4. **At KF**: Remove the standard dosing hose TZ 3874 from the valve.
   Connect the dosing hose including from the KF titration vessel TZ 1770.

All the other hoses are already preassembled.

2.7.2 Positioning and Replacing an Interchangeable Unit

The base unit comes with an RFID reader, and all the interchangeable units are equipped with an RFID transponder. This transponder can be used to store the following information:

- Unit size (cannot be changed)
- Unit ID (cannot be changed)
- Reagent name (default: blank)
- Concentration (default: 1.000000)
- Concentration determined on: (Date)
- To be used until: (Date)
- Opened/Produced on: (Date)
- Test according to ISO 8655: (Date)
- Charge description: (default: no charge)
- Last modification: (Date)

Each time an interchangeable unit is pushed onto the base unit, the data is automatically read out of the transponder.

2.7.2.1 Aufsetzen eines Wechselaufsatzes Placing an interchangeable unit

The interchangeable unit is to be placed on the device unit as is shown in fig. 16-18;
subsequently, it is to be pushed downwards until the black button latches on the left side.

Fig. 16

Fig. 17

Fig. 18

2.7.2.2 Removing an interchangeable unit

Removing the interchangeable unit is done in reverse order:

Removing the interchangeable unit is only possible as long as the piston is in the lower position (zero position). Possibly, it may be necessary to press the <**FILL**> key first.

Depress the black button on the left, and then pull the interchangeable unit forward as is shown in fig. 18-16.

2.7.3 Programming the titration unit

The data from the RFID transponder of the interchangeable unit will be read immediately (fig. 19).

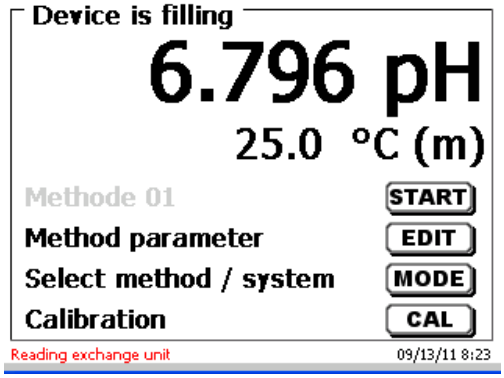

Fig. 19

Following the reading operation, the input menu for the input of the reagents will be shown for approx.10 seconds (Fig. 20).The size of the interchangeable unit is displayed on the left side of the display (here 20 ml).

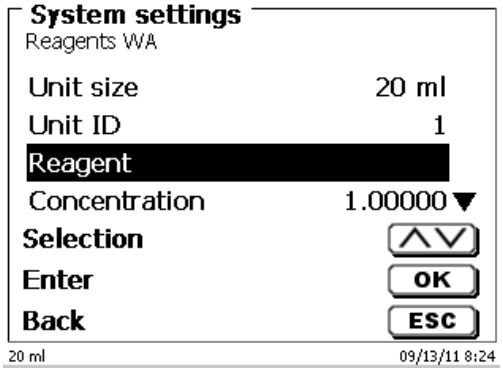

Fig. 20

It is recommended to enter here at least the name of the reagent being used.
Confirm <**Reagent**> with <**OK**>/<**ENTER**> then type the name (possible the concentration) (see fig. 21).

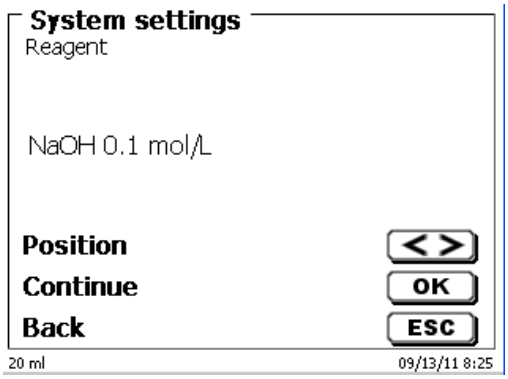

Fig. 21

Press <**OK**>/<**ENTER**> to confirm (fig. 21).
Following the optional input of additional parameter, press <**ESC**> to leave the reagents menu (fig. 22).

Important for KF:
The approximate concentration of the KF titrant (e.g. 5 or 2) should be entered under <**Concentration**>.
Thereby the drift in µg/min can be calculated in the right dimensions.

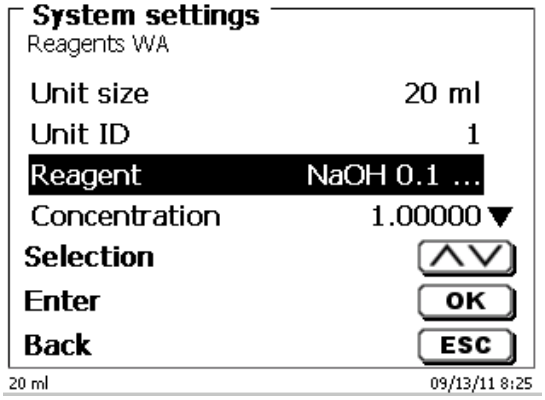

Fig. 22

You will be prompted for a confirmation of the values (fig. 23)

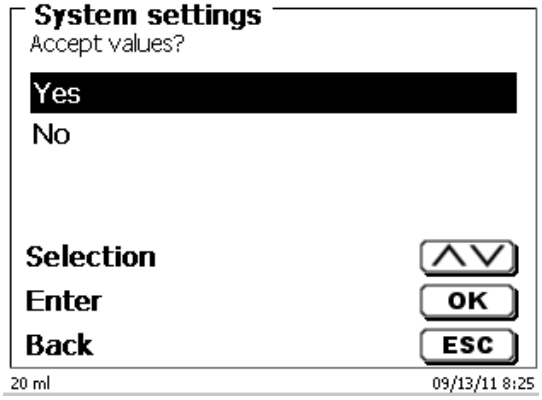

Fig. 23

If you selected <**Yes**>, the values will be written into the interchangeable unit.
In the left bottom of the display will show the new name of the reagent (fig. 24)

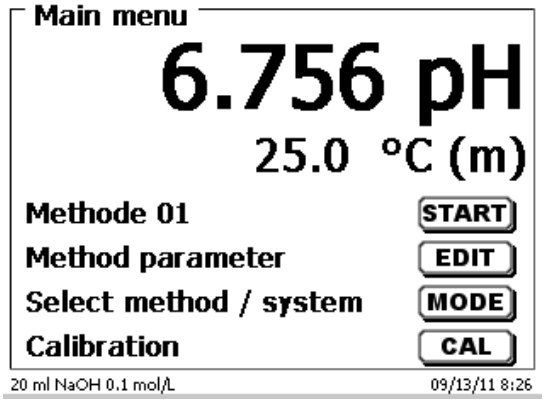

Fig. 24

2.7.4 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**> rinsing programme.

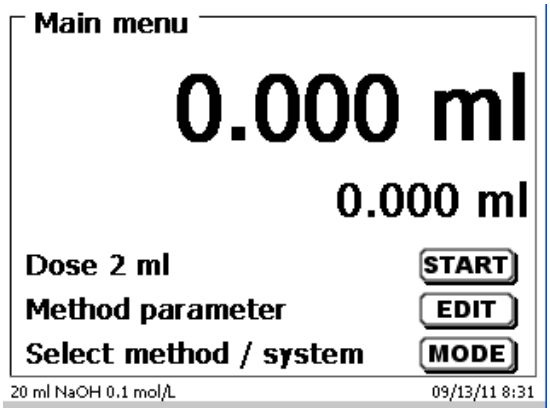

Fig. 25

On the main menu (fig. 25), press <**MODE**> key to navigate to the methods/system (fig. 26).

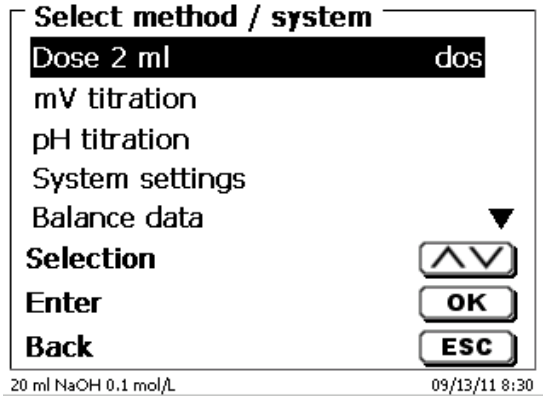

Fig. 26

Pressing <↑> twice will take you to the <**Rinsing**> selection immediately (fig. 27).

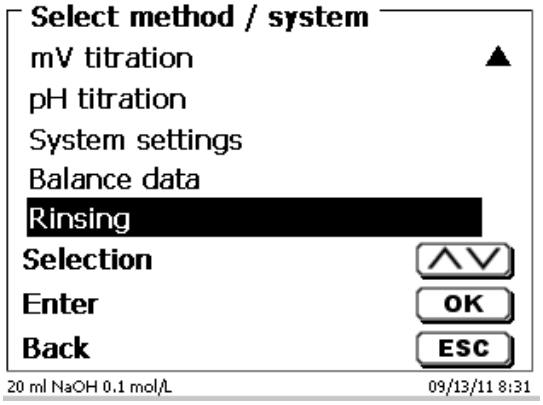

Fig. 27

Confirm the selection by pressing <**ENTER**>

At this point you can select the number of rinsing cycles (Fig.28).

Initial filling requires a minimum of two rinsing cycles!

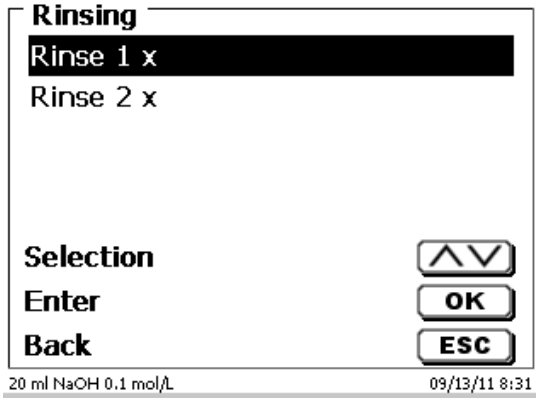

Fig. 28

You can stop the rinsing operation (Fig. 29) at any time by pressing <**STOP**> and then resume rinsing with <**START**>.

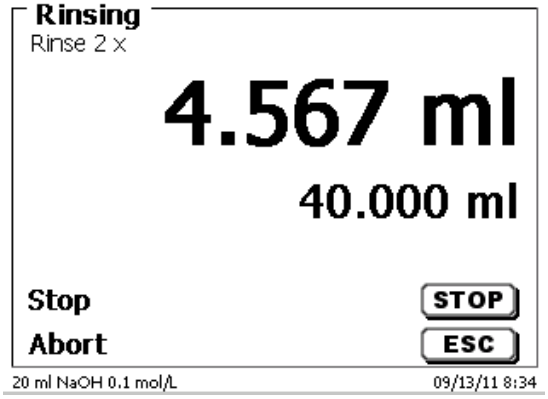

Fig. 29

2.8 KF: Filling the titration vessel with solvent

The solvent is pumped from the solvent bottle into the titration vessel by pushing down the front part of the rocker switch on the titration stand TM 235 KF.

Pump solvent (approx. 35-40 ml) into the titration vessel until the titration tip and the electrode are completely immersed (Fig.30)

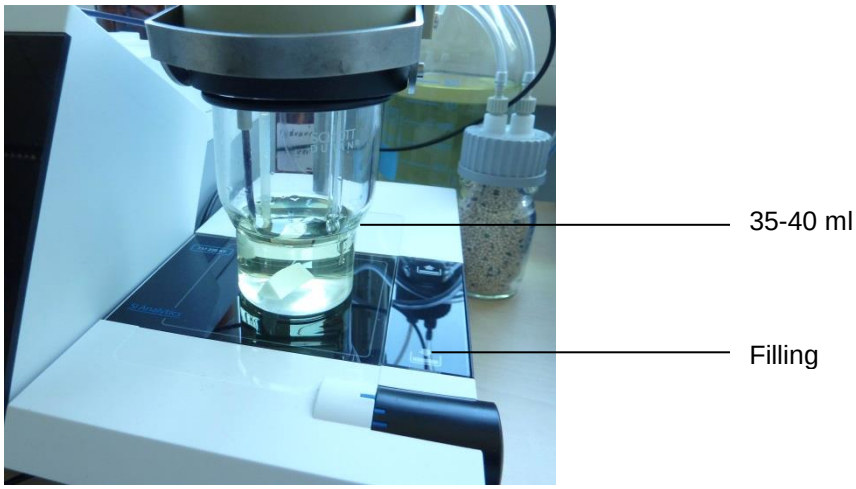

Fig. 30

2.9 Replacing the Glass Cylinder and the PTFE Piston

As a rule, the hoses and cylinders will contain chemicals which may spill or be splashed around in the course of disassembly. The relevant safety precaution measures applicable to the handling of the chemicals concerned have to be absolutely observed!

Replacing the glass cylinder and the piston does not require any additional tools.
In certain cases the piston extractor has to be used.

- Remove the interchangeable unit from the base unit.
- Unscrew the hose between the glass cylinder and the valve from the glass cylinder.
- Rotate the blue UV protection 5 to 6 times to the left to loosen it.
- Remove the UV protection and pull out of the glass cylinder together with the piston inside it.
- Insert a new glass cylinder and piston (Fig. 31) into the interchangeable unit, and then slip on the blue UV protection again. Tighten the blue UV protection again by rotating it 5 to 6 times to the right.
- The piston rod must project 0.5 cm out of the interchangeable unit (Fig. 32).
- Tilt the unit forward until the slanted bottom side is in flat contact with the lab table (Fig. 33).
  This forces the piston into its correct position.

If the piston be forced too far into the glass cylinder, simply pull it out and place it in the correct position according to the procedure described above.

Fig. 33

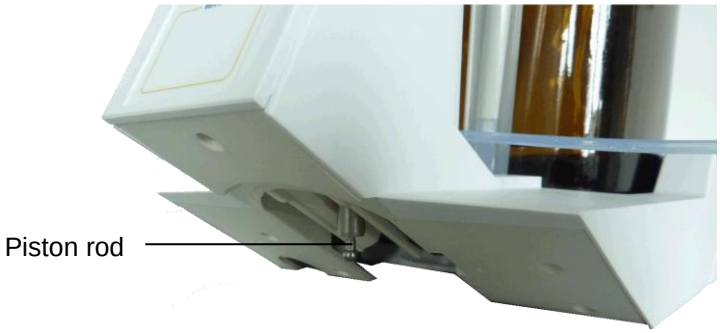

Fig. 33

Fig. 33

The interchangeable unit and the cylinder size have to correspond. Otherwise the coding, which is memorized within the interchangeable unit will no longer match the cylinder size. This will trigger incorrect dosage.

For the sake of dosing and analytical accuracy, it is also recommended to replace the PTFE piston each time a defective glass cylinder is replaced. Broken glass may damage the sealing rings of the PTFE piston.

2.10 Combination with Accessories and Additional Devices

2.10.1 Connecting a printer

Printers with a USB interface are to be connected to one of the two USB-A interfaces.

These printers **have to** feature HP PCL emulation (3, 3 enhanced, 5, 5e).
So-called GDI printers cannot be used!

Alternatively the thermo-compact printer Seiko S445 can be connected.

2.10.2 Connecting a USB device (manual controller, keyboard, memory device, hub)

The following USB devices can be connected to the USB-A interfaces:

- PC-keyboard
- TZ 3880 manual controller
- Printer
- USB storage devices, e.g. USB sticks
- USB hub
- USB barcode scanners

2.10.3 Connection of analytical balances

Analytical balances are to be connected to the RS232-2 using an appropriate cable.

2.10.4 Connection of SI Analytics® ID electrodes to TitroLine® 7800

The connector of the ID electrode contains a bead. This bead can be used as a marker for connecting the electrode to the mV/pH socket. The bead should possibly point upward to the reference socket or in between (also refer to Fig. 1). The identification of the ID electrode is thereby simplified. Data of the connected ID electrode are read out immediately after the connection and stored in the titrator. This includes the calibrating data, such as zero point and slope, date of the calibration, buffer solutions used, the serial number and type of electrode.

2.10.5 Connection of SI Analytics® IDS® electrodes to TitroLine® 7800

Socket of IDS® sensors is a round connector which is flattened on one side.

When connecting, make sure that the flattened part of the round connector pointing downwards

Thus, the electrode is detected must be loaded one method that the IDS® measuring input and the desired parameter also used. If, for example, a conductivity -IDS® electrode joined should also be used in the method as a measurement parameter µs/cm

If the method is loaded, but no electrode has not yet been connected, the following message appears

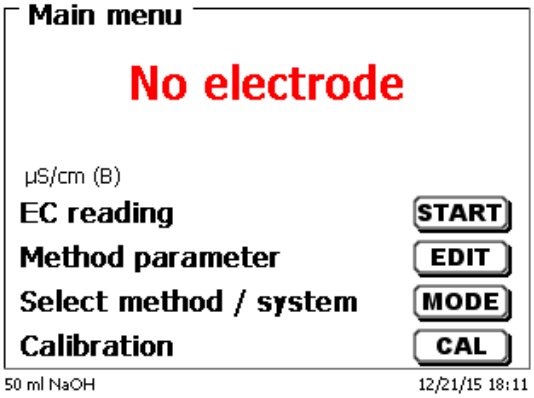

Fig. 34

If you connect the electrode, the electrode menu is automatically displayed with the characteristics of the electrode (such as name, batch number, etc.) for about 10 seconds:

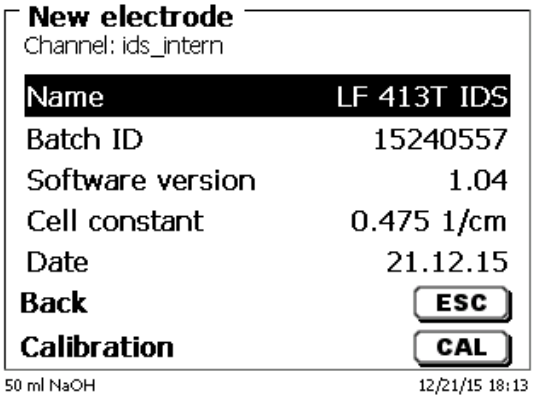

Fig. 35

The display then switches to the normal display, showing in this case, the conductivity in µs/cm and the temperature:

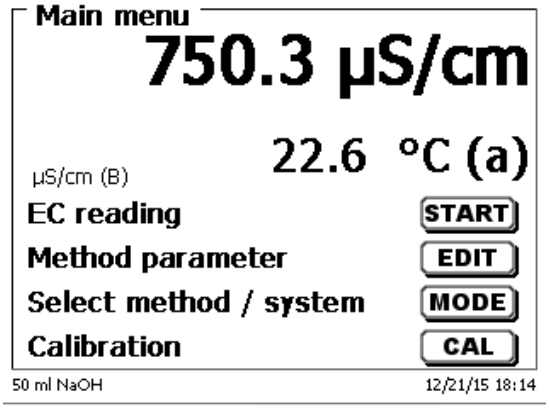

Fig. 36

Are, for example, two measurement parameters are selected in the method, the display looks like this:

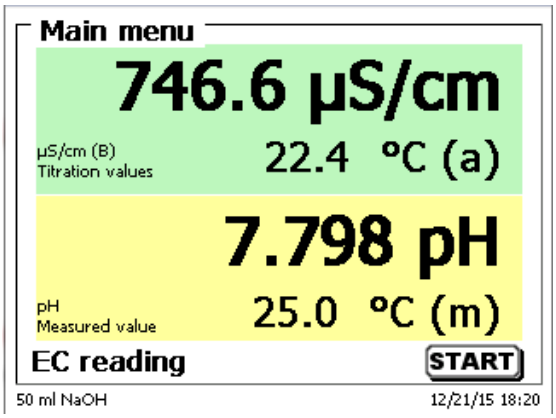

Fig. 37

To distinguish between the two measurement parameters, the backgrounds are highlighted in color in this case

3 Working with the Titrator TitroLine® 7800

3.1 Front Keyboard

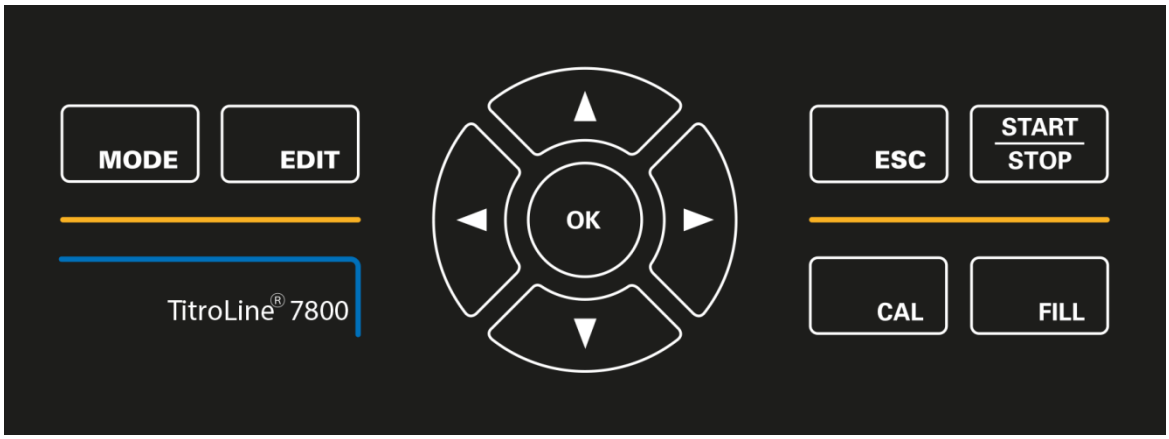

Fig. 38

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.

<Mode>: Methods selection, rinsing, system settings
<EDIT>: changing the current method, new method, copy and delete method
<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 🕮 **Chapter 3.4**, **"**External PC Keyboard".

3.2 Display

The display (Fig.39) 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.

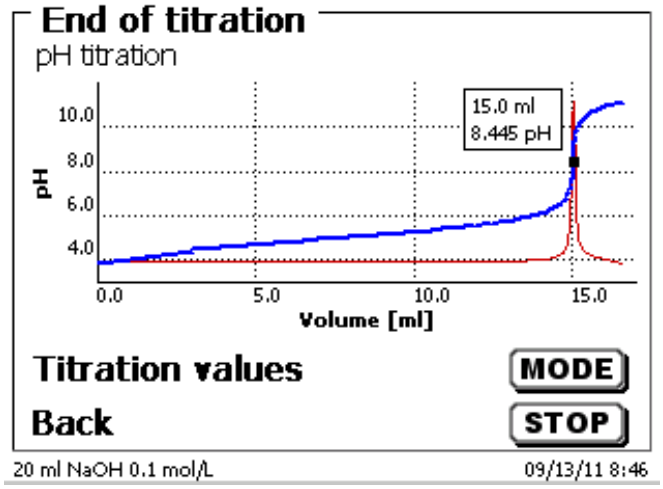

Fig. 39

3.3 Manual controller

The manual controller (Fig. 40) is needed for manual titration.
It can also be used for starting dosage or other methods

Fig. 40

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

Keys	Function
<**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. 41).

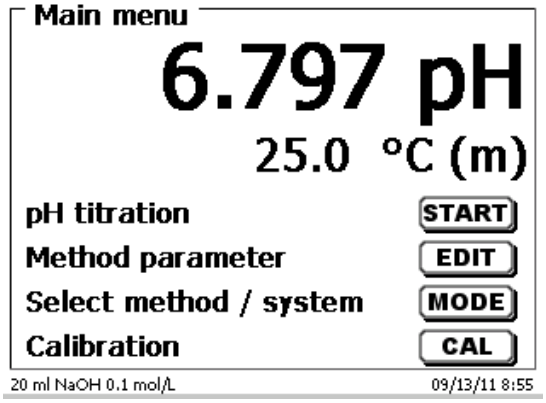

Fig. 41

Pressing <**START**> will result in the immediate execution of the method shown.
<**EDIT**>/**F3** will take you to the method parameters (Fig. 42).

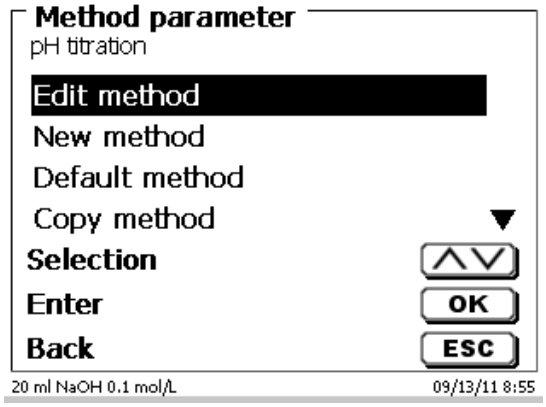

Fig. 42

At this point you can

- modify the current method
- create a new method
- call and memorise standard methods
- copy or delete an existing method

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

<**MODE**>/**F6** leads you to the “select method“ menu (Abb. 43).

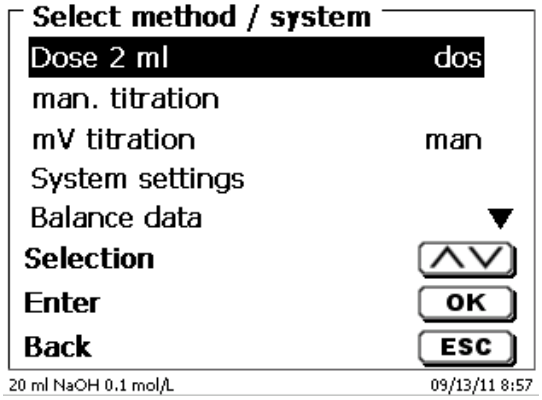

Fig. 43

Existing methods can be selected by pressing <↓> and <↑> and confirming the selection with <**OK**>/<**ENTER**>.
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. 44 and Fig. 45) you can use the <**SYS**>/**F7** key;
you can also navigate there through the method selection menu.

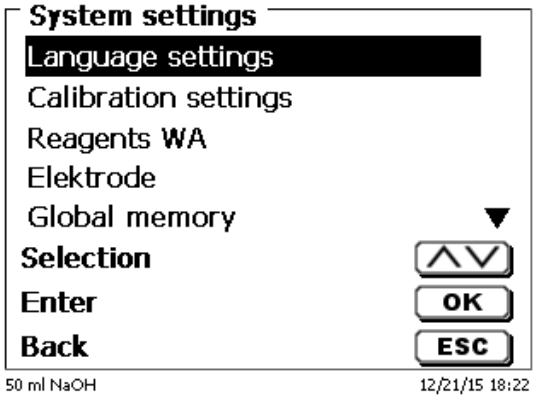

Fig. 44

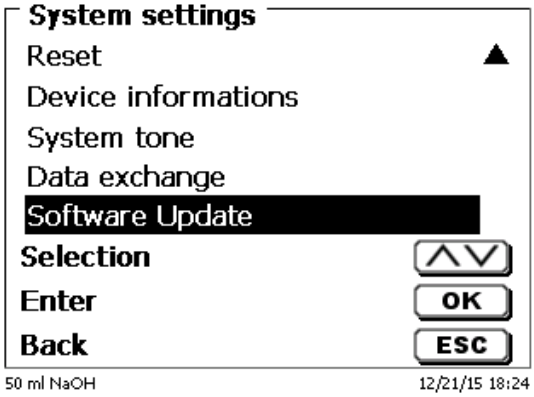

Fig. 45

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. 46).

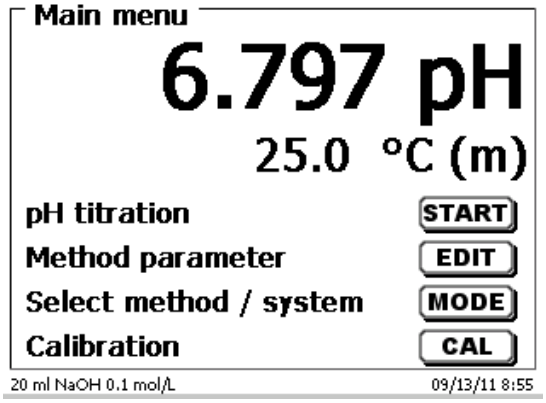

Fig. 46

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. 47) and the weighed-in quantity (Fig. 48). You can use an external PC keyboard for entering a 20-digit alphanumeric sample ID

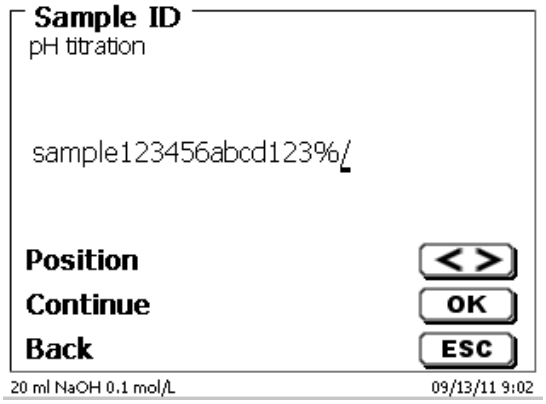

Fig. 47

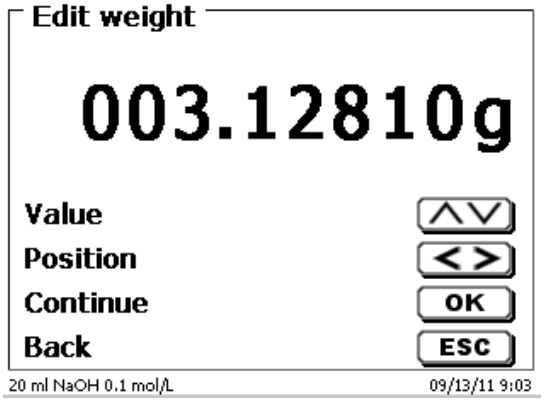

Fig. 48

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

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 to indicate that no balance data are present:

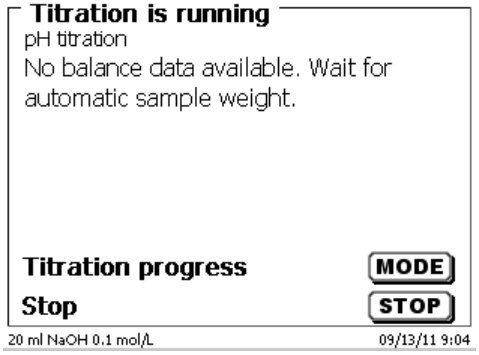

Fig. 49

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 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.

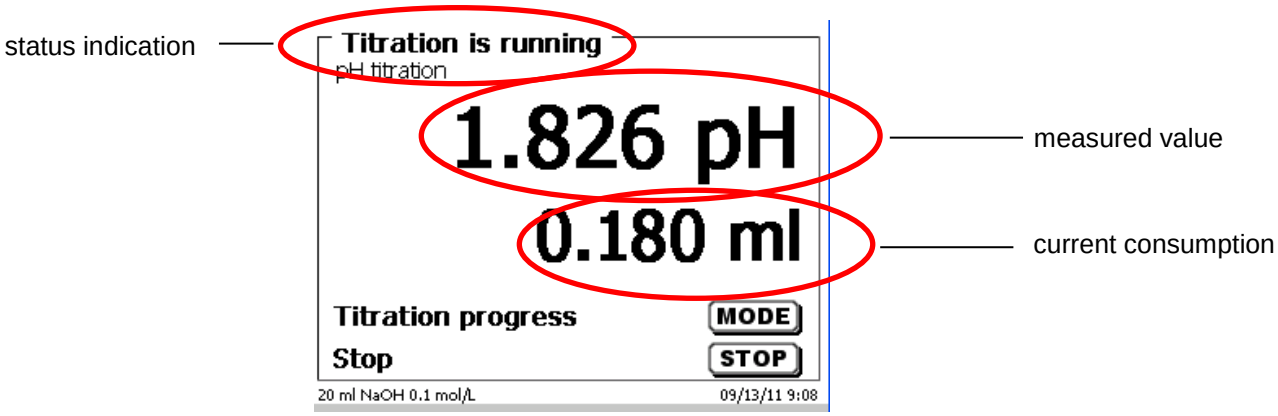

Fig. 50

Pressing the <**Mode**>/<**F6**> will cause the titration curve to be displayed (Fig. 51).

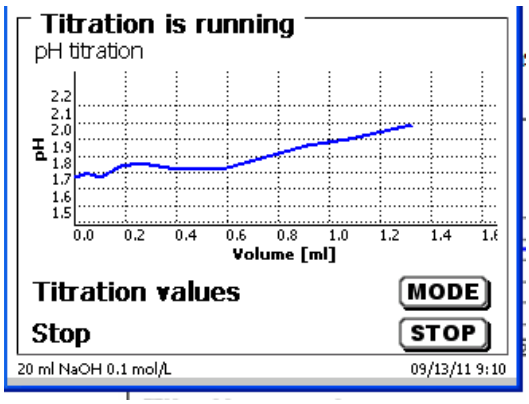

Fig. 51

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.

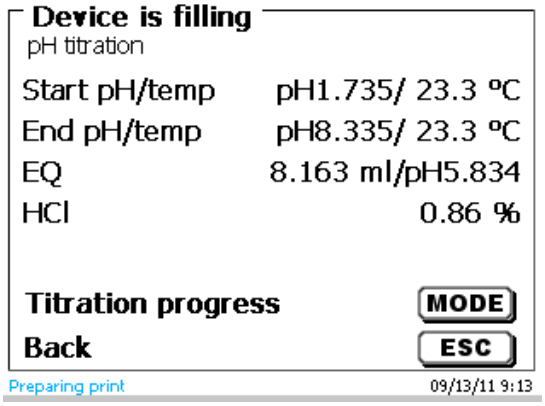

Fig. 52

<**MODE**>/<**F6**> can be used to view the titration curve or further resuts. 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.

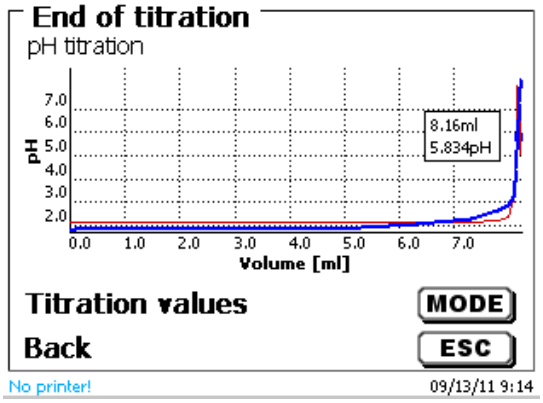

Fig. 53

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 will show a message (Fig.53).

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

3.6.2 Calibration

If you are on the main menu (Fig.547), calibration is started by pressing the <**CAL**> key on the titrator or the <**F8**/**CAL**> key.

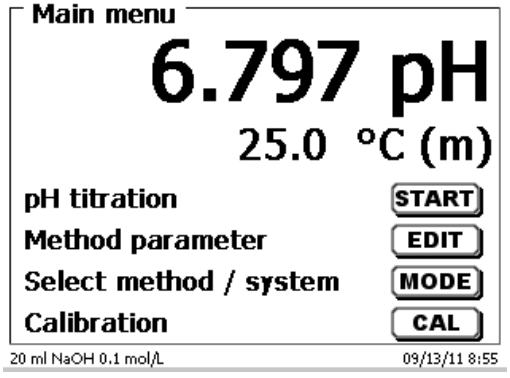

Fig. 54

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

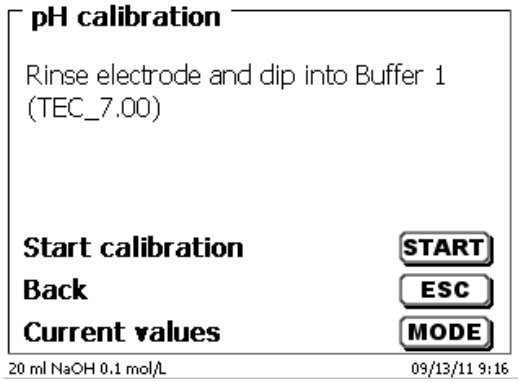

Fig. 55

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

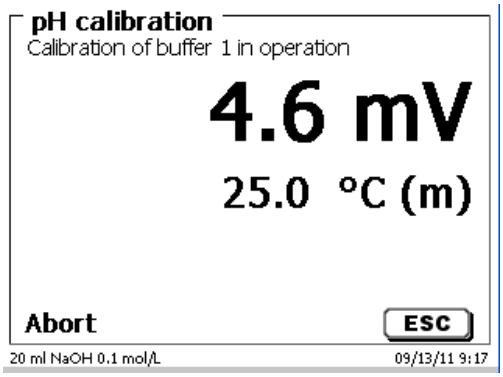

Fig. 56

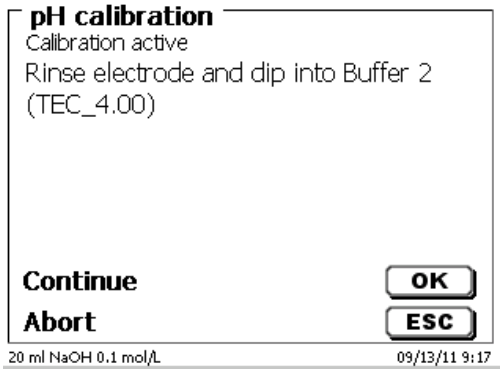

Fig. 57

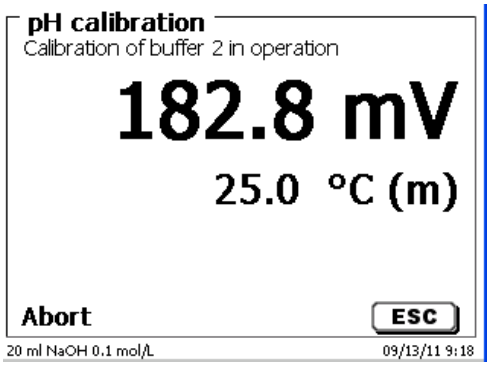

Fig. 58

Once calibration completed, the display will show the slope and the zero point of the electrode:

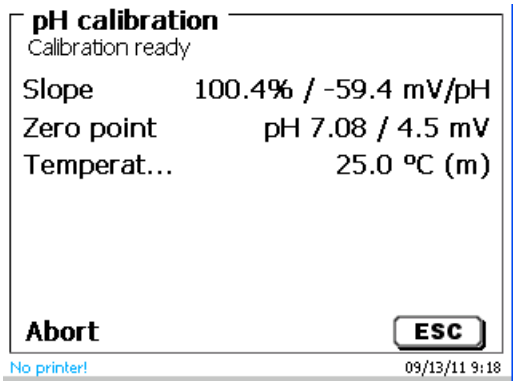

Fig. 59

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 by pressing <**CAL**>:

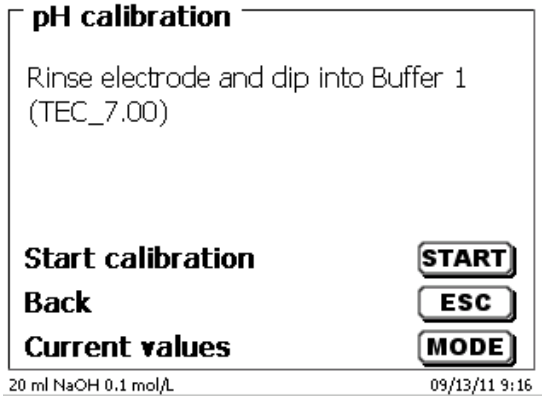

Fig. 60

Follow by <**Mode**>:

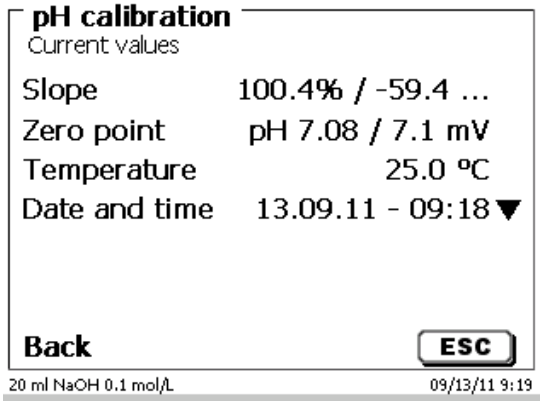

Fig. 61

Is a digital pH electrode connected to the measuring input B and B is used in the method of measuring input for pH measurement, has yet to select after calling the calibration routine, if a pH electrode to the measuring input A (analog) or a digital (IDS®) to calibrate electrode

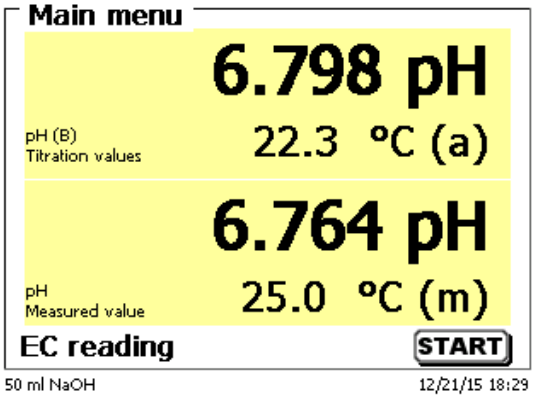

Fig. 62

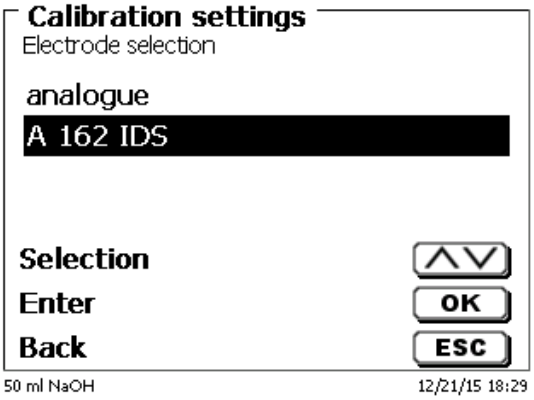

Fig. 63

The sequence of the calibration of the digital pH electrode is identical to the calibration of the analog pH-electrode.

3.6.3 Manual Titration

Manual titration is always performed using the manual controller.
Manual titration is impossible without the manual controller.

The mV or pH reading will be displayed.
The value can be selected in the “Titration parameter“ menu item (in fig. 64, for example, the pH value)

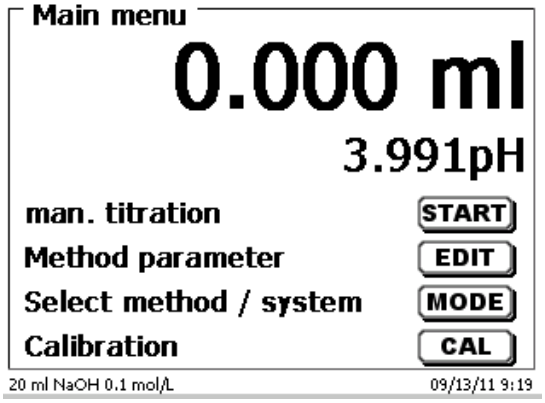

Fig. 64

<START>/<F1> 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 are regarding automatic titration in 🕮 **Chapter 3.6.1**), the following display will appear:

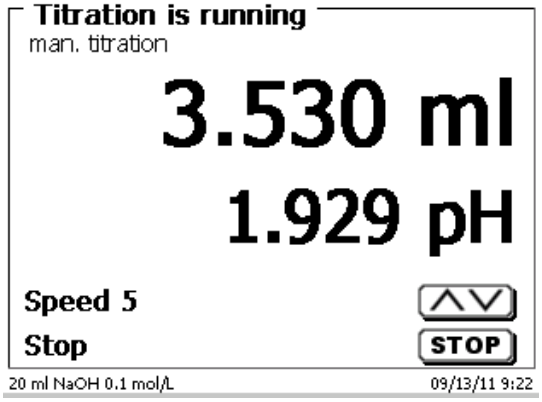

Fig. 65

You can control the metering rate with the black key of the manual controller.

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 0.0005 ml (WA 05), 0.001 ml (WA 10), 0.002 ml (WA 20) and 0.005 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.

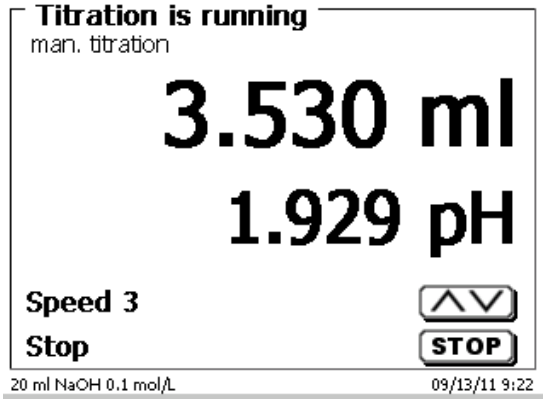

Fig. 66

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

Example:

WA 20 interchangeable unit

Stage 5	100 %	(approx. 40 ml/min)
Stage 5	50 %	(approx. 20 ml/min)
Stage 4	25 %	(approx. 10 ml/min)
Stage 3	12,5 %	(approx. 5 ml/min)
Stage 2	6,8 %	(approx. 2,5 ml/min)
Stage 1	3,4 %	(approx. 1,25 ml/min)

Even if the titration is completed, press <**STOP**/**F2**> or approx. for 1 sec. the grey key of the manual controller. The titration result will be calculated and displayed.

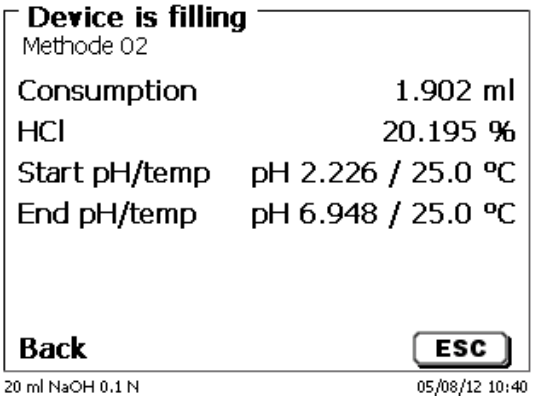

Fig. 67

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 KF Titration

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

The preconditioning is run first.

The solvent and the titration vessel contain moisture (water) that should not influence the calculation of the result.
The conditioning is run automatically after <**START**/**F1**> are pressed.
The final conditions are the same as the conditions of the actual sample titration.

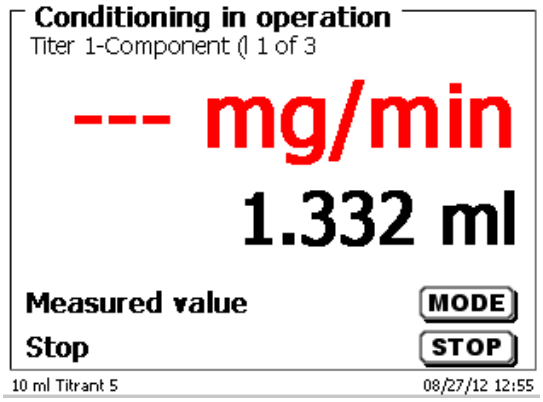

Fig. 68

When the final criteria are met, then there is an audible signal and Conditioning ready is shown on the display:

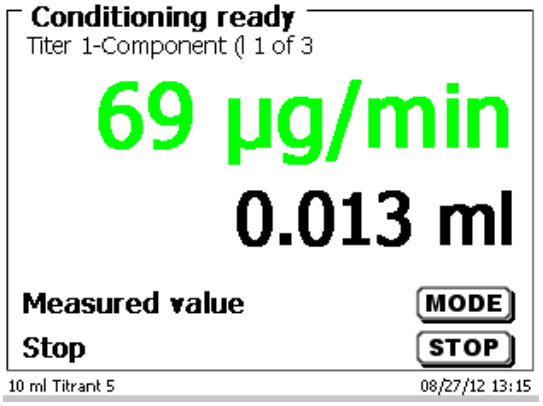

Fig. 69

The conditioning remains active until the actual titration is started by pressing **<F1/Start>**.
You are prompted immediately to add the sample:

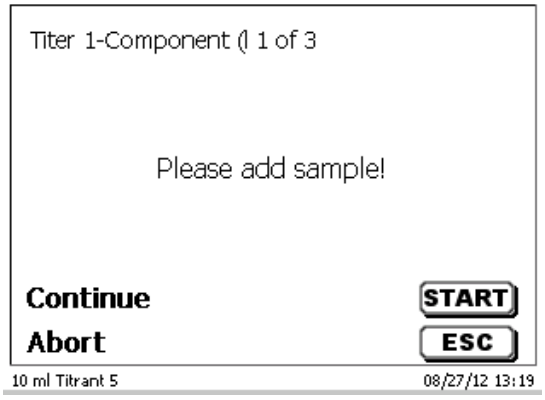

Fig. 70

After the sample or the standard is added, you must press **<F1/Start>** again.

Depending on the method settings, you will be prompted for the sample identification (Abb. 71) and the weighed-in quantity (Abb. 72).
You can use an external PC keyboard for entering a 20-digit alphanumeric sample ID.

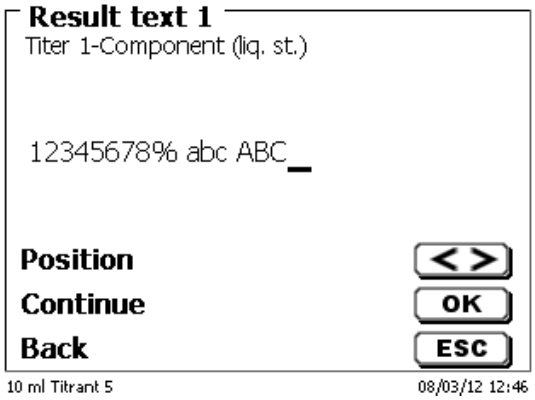

Fig. 71

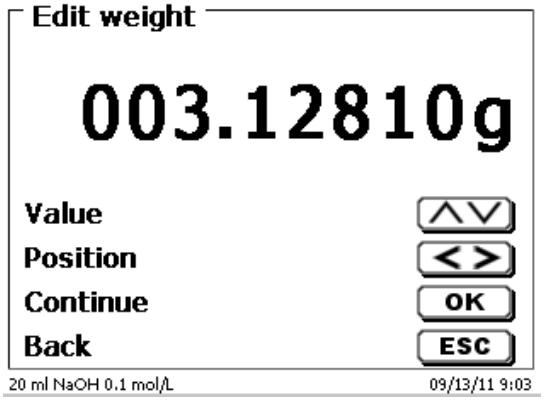

Fig. 72

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

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 to indicate that no balance data are present:

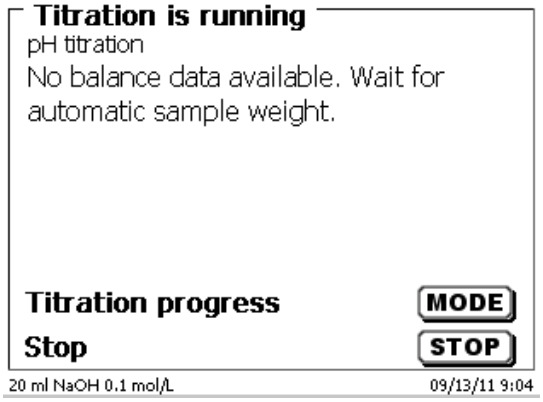

Fig. 73

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 shows either

- the use in ml with the drift in µg/min
- or the drift with the measured value in µA
- or the titration curve in ml/time [s].

You can switch between the individual displays with <**F6**/**MODE**>.

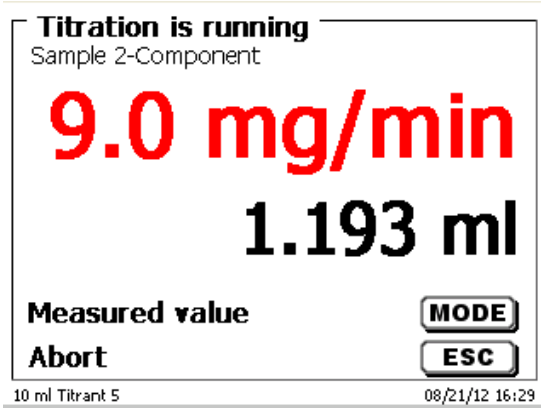

Fig. 74

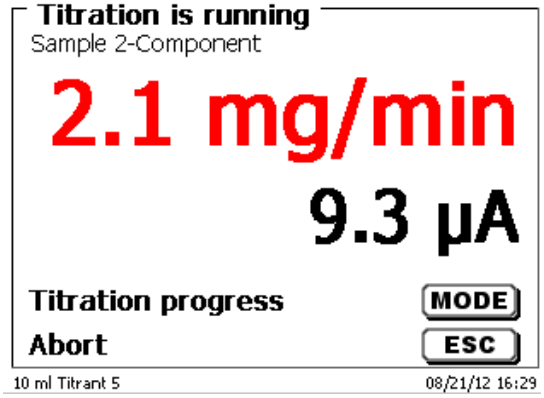

Fig. 75

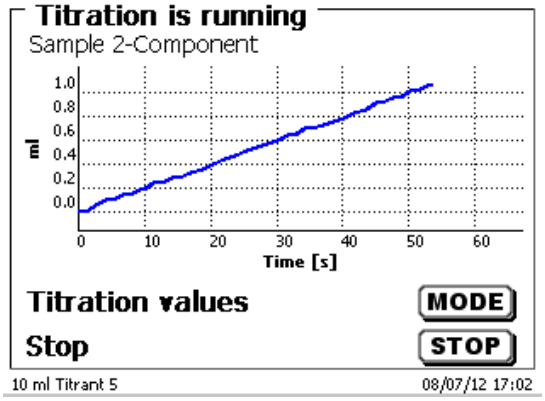

Fig. 76

Scaling of the chart will be done automatically. The result will be displayed at the end of the titration.

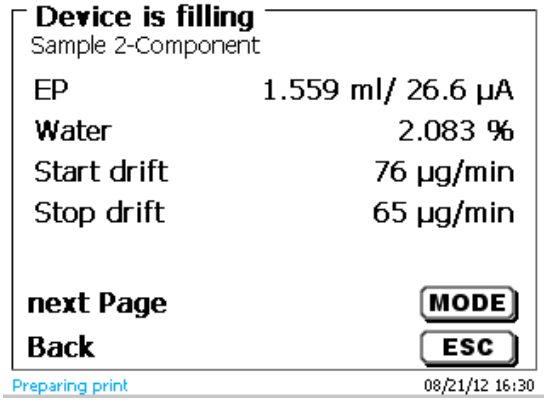

Fig. 77

<**Mode**>/<**F6**> can be used to view the titration curve or further results.

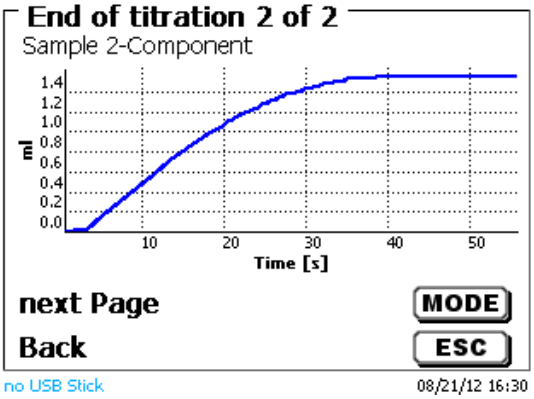

Fig. 78

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, you get a massage on display.

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

3.6.5 Dosage

3.6.5.1 Dosing operation with dosing method

To start a dosage method, please use <**START**>/<**F1**> or the black key of the manual controller.

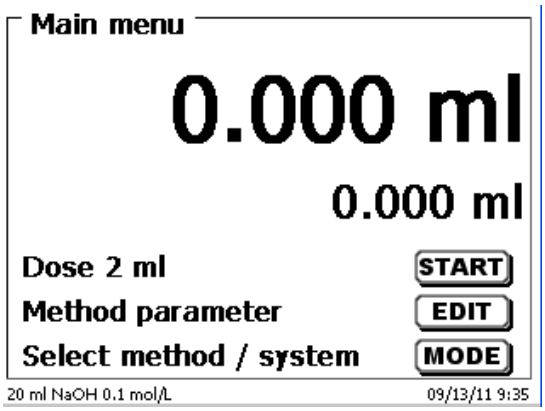

Fig. 79

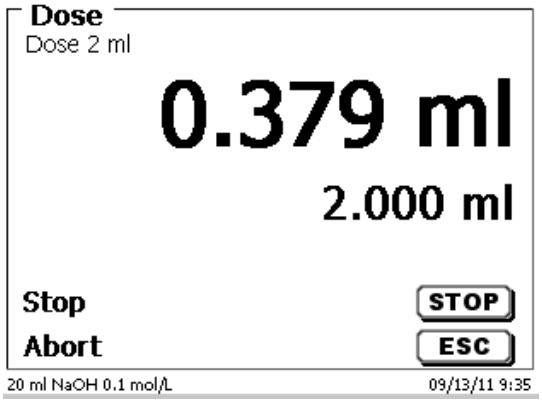

Fig. 80

The dosed volume will be briefly displayed before the display returns to the main menu.

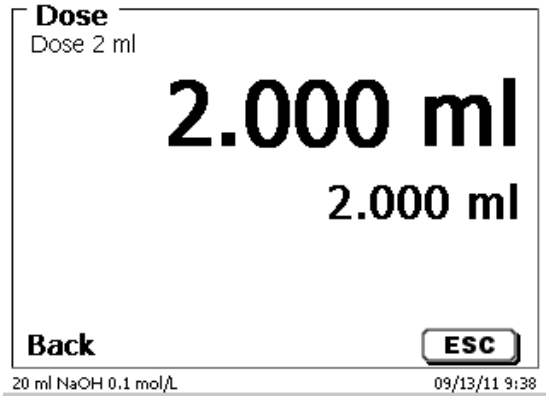

Fig. 81

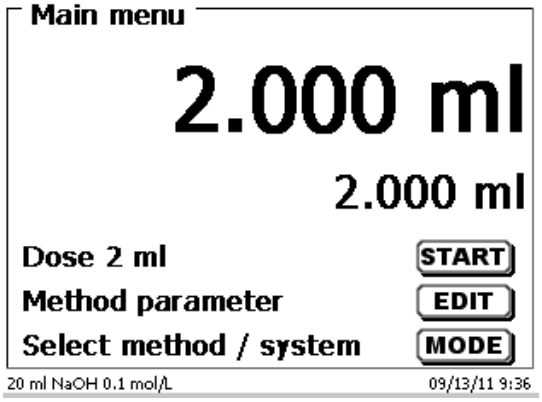

Fig. 82

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.

3.6.5.2 Dosing operation without dosing method

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

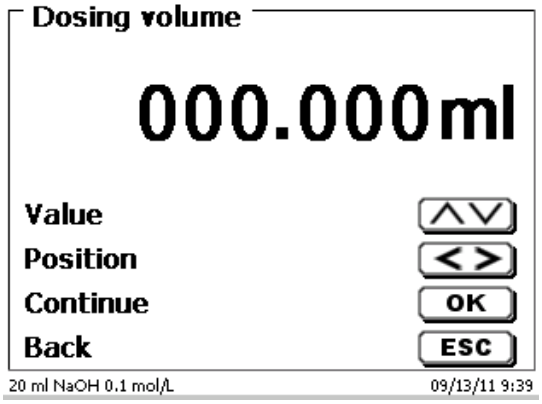

Fig. 83

This is the point to input the volume which will be dosed following the confirmation with <**ENTER**>/<**OK**>.

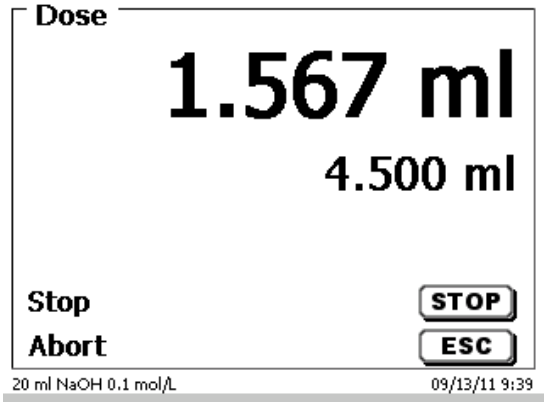

Fig. 84

This is the point to input the volume which will be dosed following the confirmation with <**ENTER**>/<**OK**>.

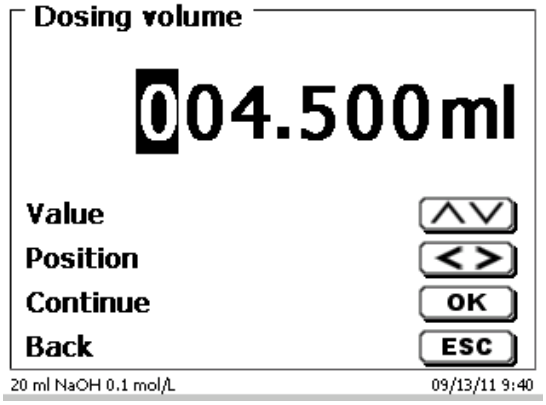

Fig. 85

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

3.6.6 Preparing Solutions

The so-called “Preparing solutions“ method is a special dosing method. In this process, a solvent is dosed to a sample weight of a substance until the desired target concentration is reached:

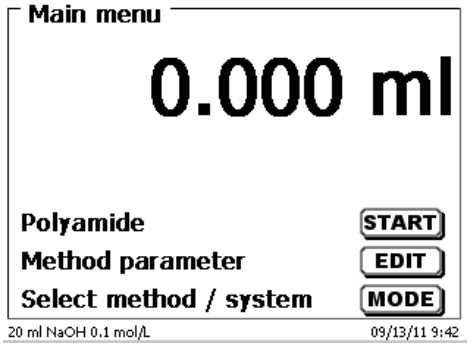

Fig. 86

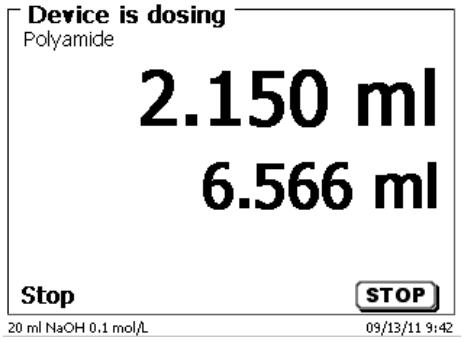

Fig. 87

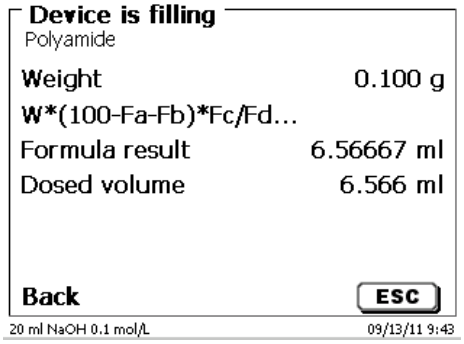

Fig. 88

If the calculated volume is greater than the maximum volume, an error message will be displayed and dosage will be suppressed for safety reasons:

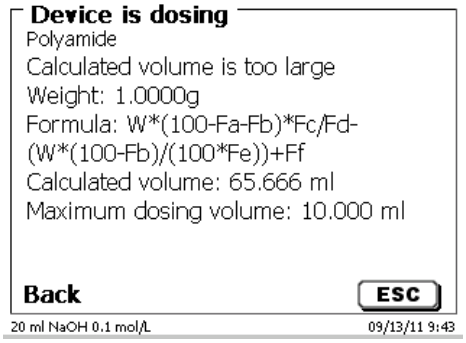

Fig. 89

4 Method parameters of the potentiometric titration

From the main menu, <**EDIT**>/<**F3**> will take you to the method parameters

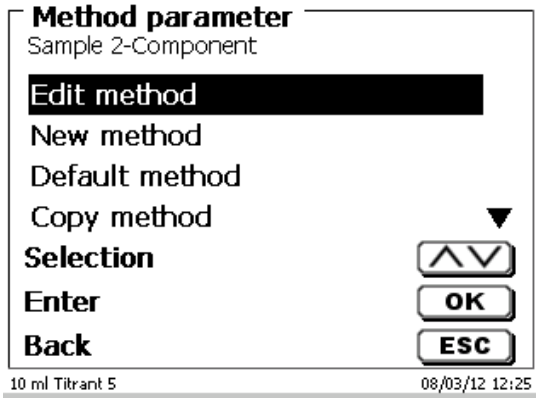

Fig. 90

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. 91).
This prompt will not appear in the case of the modification of an already created method.

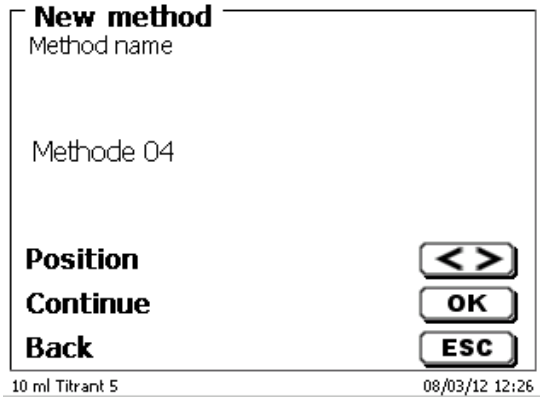

Fig. 91

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 <**OK**>/<**ENTER**> to confirm the input.

The method name can be changed at any time.

Please continue at this point with 🕮 **Chapter 4.6**

4.2 Default method

The <**Default methods**> item of the TitroLine® 7800 contains a series of ready-made standard methods which can be conveniently selected

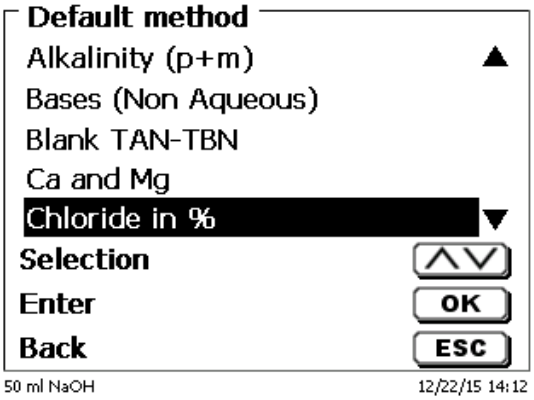

Fig. 92

Once the selection made, you are directly prompted for the input of the method name:

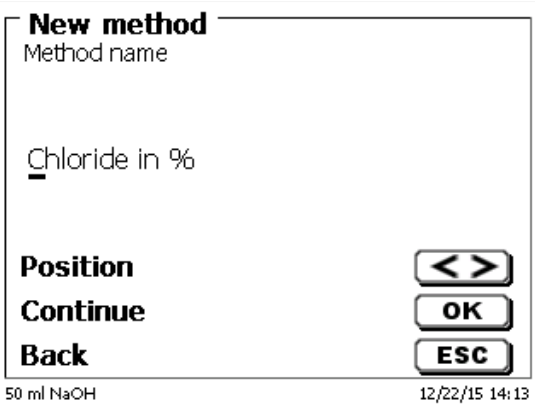

Fig. 93

The standard name may be adopted or modified.

Subsequently, you will be taken to the <**Change method parameters**> item.

Please continue at this point with 🕮 **Chapter 4.6**

4.3 Copy Method

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

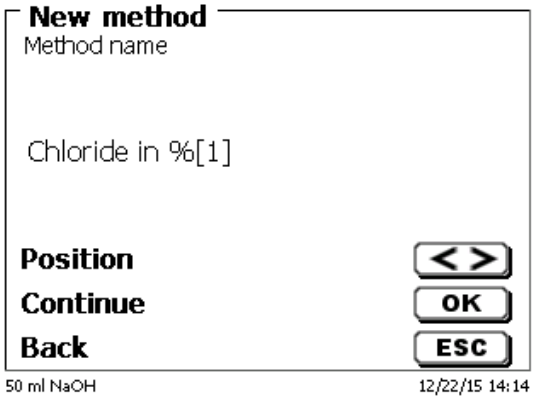

Fig. 94

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 the <**Change method parameters**> item.

Then you proceed with **Chapter** 🕮 **4.6**

4.4 Delete Method

If this function is selected, you will be prompted to know whether the current method is actually to be deleted. You have to reply <**Yes**> in explicit terms and also confirm this reply with <**OK**>/<**ENTER**>.

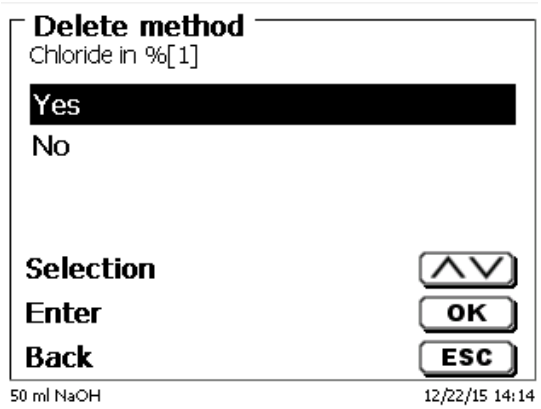

Fig. 95

4.5 Print method

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

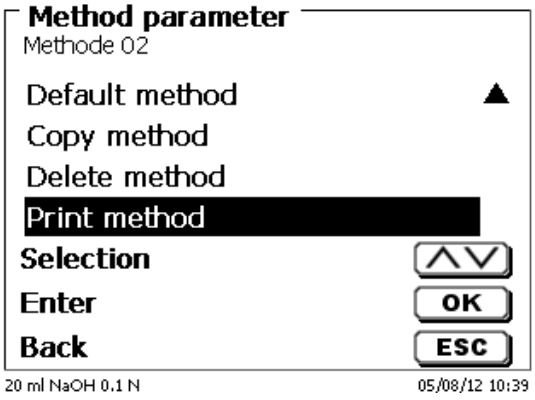

Fig. 96

4.6 Change Method Parameters

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

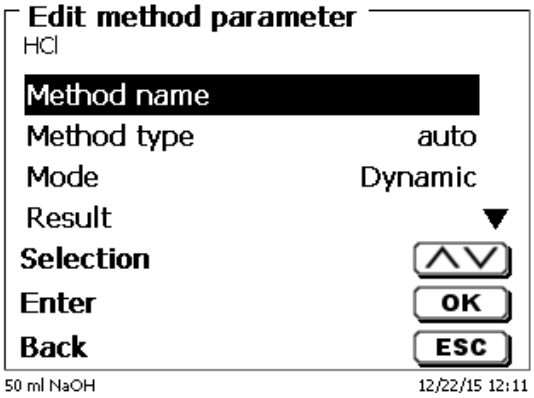

Fig. 97

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:

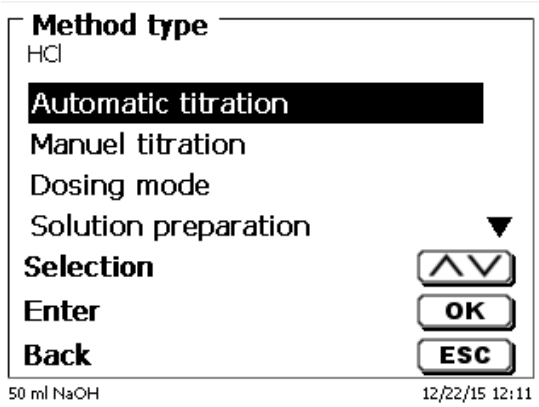

Fig. 98

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, mV)
- Dead Stop titration (µA)
- KF- Titration
- pH Stat Titration (pH)

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. 99).

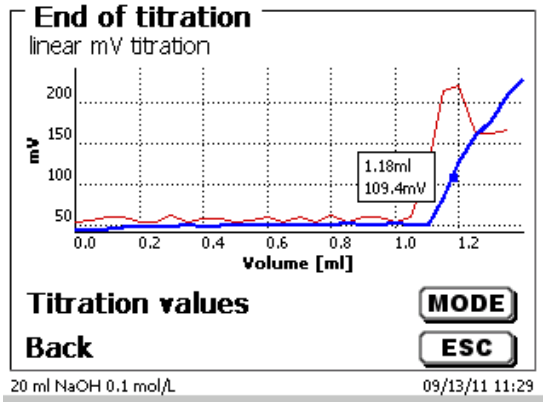

Fig. 99

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

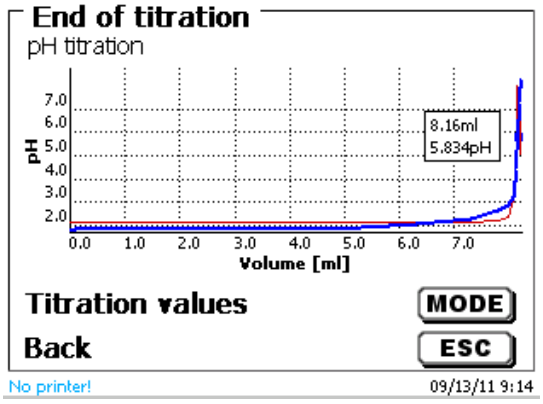

Fig. 100

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: 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.

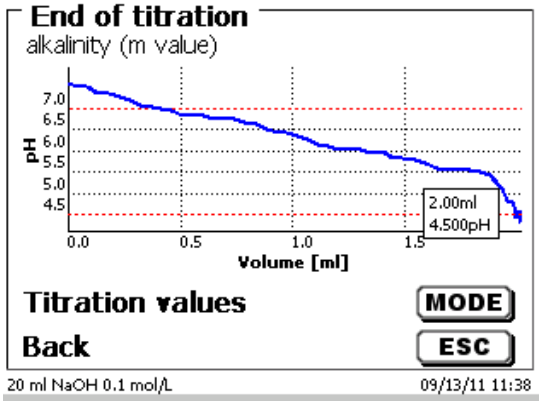

Fig. 101

4.6.2.4 pH Stat Titration

The pH Stat Titration is a special form of the pH endpoint titration, which takes place in two different stages. In the first stage, the desired pH value is first titrated and the pH value is kept constant over a set time during the second stage.

In the first stage, the TitroLine® 7800 acts just like a normal pH endpoint titration (see above). That is, the pH value is drift-controlled during the last phase before the endpoint or taken over as usual at a fixed delay. In this phase, additions were made by titration at linear increments. But once the desired pH is reached, it is immediately switched to the second stage, the actual pH-stat level. This means that the drift control is now omitted and a fixed waiting period of "zero" seconds occurs between the titration stage and the measurement value acquisition. This is also necessary; otherwise you could not maintain the pH value over a set period in many cases.

During the titration, the pH/time or the ml/time curve and the pH value/ml can be displayed analog.

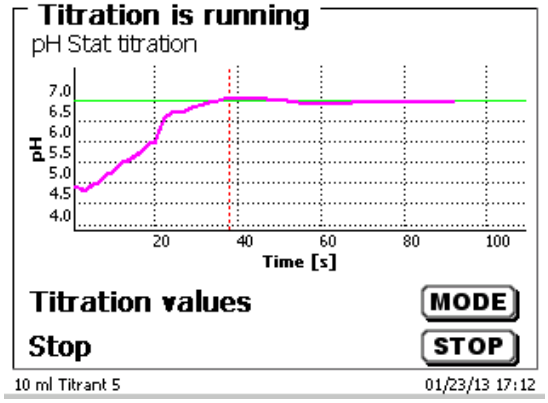

Fig. 102

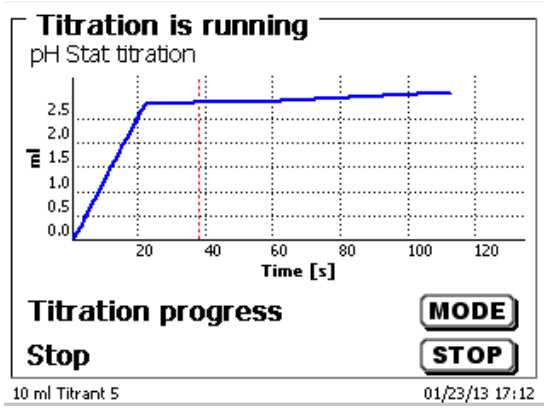

Fig. 103

4.6.3 Result

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

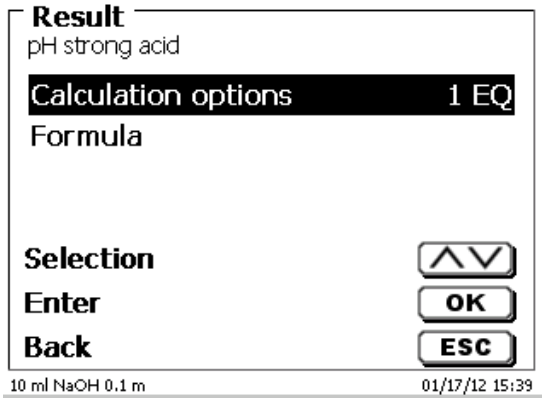

Fig. 104

Up to 2 inflection points (2 EQs) can be analyzed in the TitroLine® 7800.

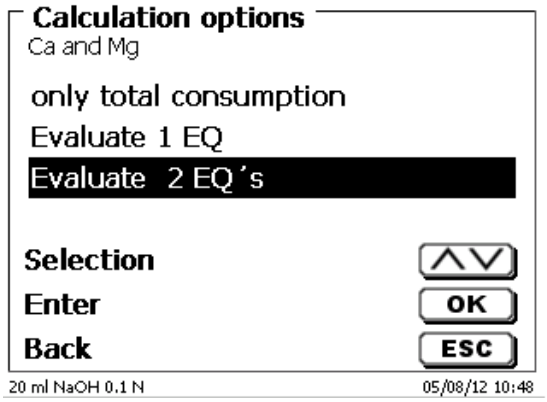

Fig. 105

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

With „**1 EQ**“ respectively “**2 EQ´s**” the calculated equivalence points of the titration curve will be used.

” **Formula“** offers the following settings:

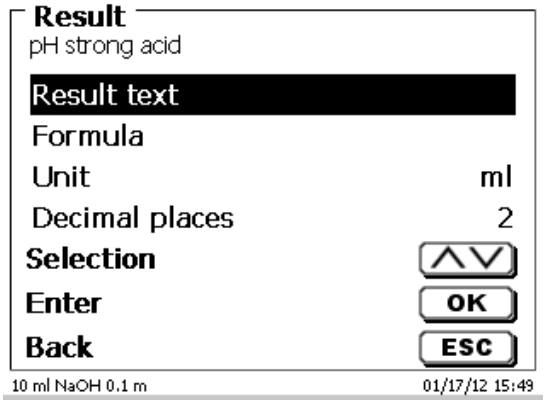

Fig. 106

The **Result text** may contain up to 21 alphanumeric characters including special characters:

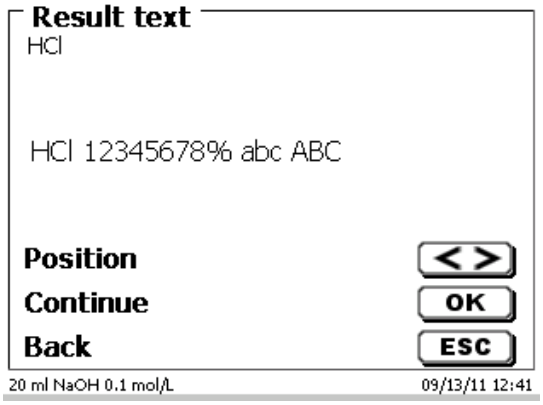

Fig. 107

Please confirm your input with <**OK**</<**ENTER**>.
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.

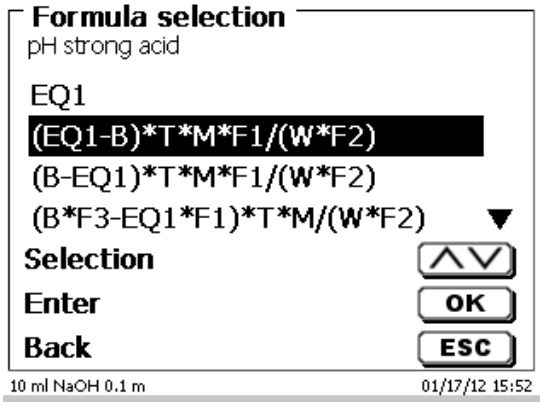

Fig. 108

If two inflection points (2 EQs) are selected, formula 1 and formula 2 can be selected

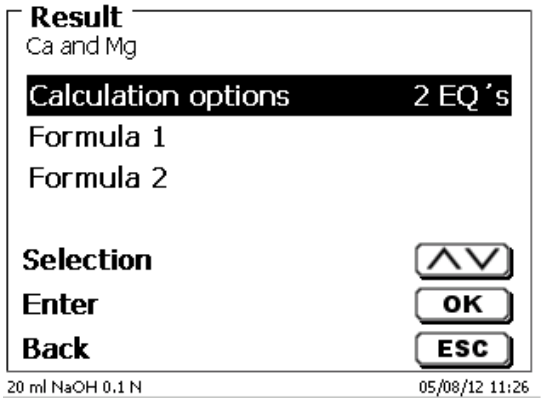

Fig. 109

The calculation formula for the 2nd EQ is selected for the second formula.

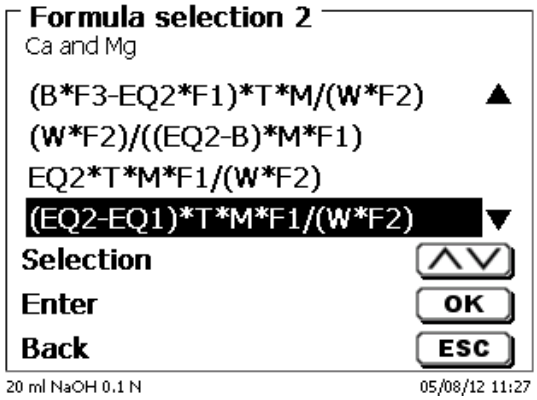

Fig. 110

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).
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

Formula for linear and dynamic titration to EQ2		**Information**
EQ2		Calculation of the consumption at EQ2 in ml
(EQ2-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 EQ2 (ex.:phosphoric acid)
(B–EQ2)*T*M*F1/(W*F2)		Formula for calculating the concentration of a sample taking into account a blank value in terms of ml. Back titration
(B*F3–EQ2*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.
(EQ2-EQ1)*T*M*F1/(W*F2)		Formula for the calculation of the concentration of a sample. Direct titration to 2 EQ. Here calculation of the difference between EQ2-EQ1. (ex. magnesium)
(F3*EQ2-EQ1)*T*M*F1/(W*F2)		Formula for the calculation of the concentration of a sample. Direct titration to 2 EQ. Here calculation of the difference between EQ2-EQ1.
(W*F2)/(EQ2-B)*M*F1)		Formula for calculating a titer (T) of a titration solution using EQ2.
(W*F2)/(EQ2-B)*M*T*F1)		Formula for calculating the concentration of a sample taking into account a blank value in ml. Direct titration to EQ2.
(W*F2)/(B-EQ2)*M*T*F1)		Formula for calculating the concentration of a sample taking into account a blank value in ml. Back titration Titration to EQ2
(EQ2*F1)-F2		Calculation of consumption at EQ2 including multiplicative and subtractive factors F1 and F2
(EQ2-EQ1)*F3		Calculation of the difference between EQ2 and EQ1 including one multiplicative factor F1
	ml	For pH Stat: only total consumption
	ml*T*M*F1/(W*F2)	For pH Stat: formula for total consumption taking into account the sample amount and further factors
	S*T*M*F1/(W*F2)	For pH Stat: formula for calculation of the slope in ml/s taking into account of calculation factors incl. weight/pattern.

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 <**OK**>/<**ENTER**>.

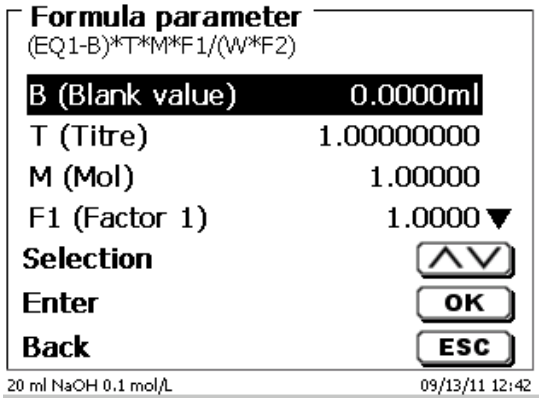

Fig. 111

The values for the blank value, the titers and factors F1-F5 can be entered or read from a global memory. The values from the global memory were defined in advance by a titration or were manually entered.

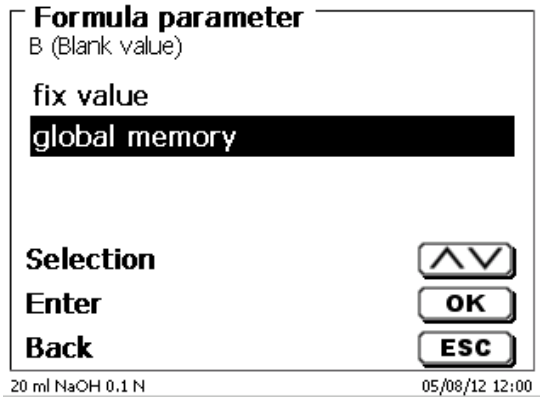

Fig. 112

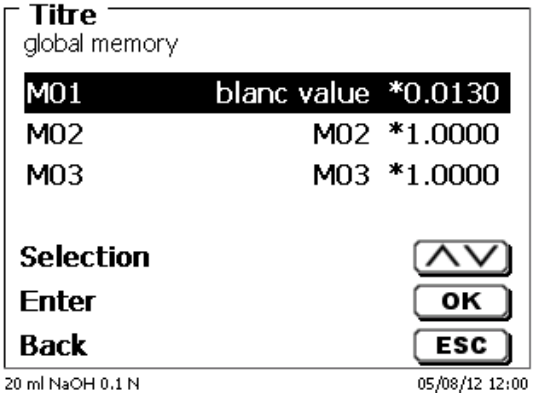

Fig. 113

The global memory used is displayed. (Fig. 114, it is M01).

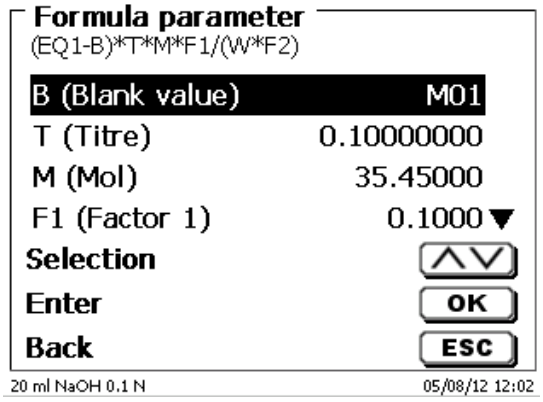

Fig. 114

Storing results in global memories is described in 🕮 **Chapter 4.6.3.7**

The values of the individual parameters of the selected calculation formula can now be input one by one.

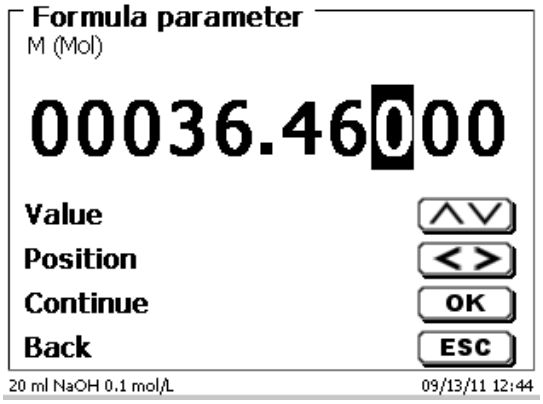

Fig. 115

4.6.3.2 **Sample weight and volume (sample quantity)**

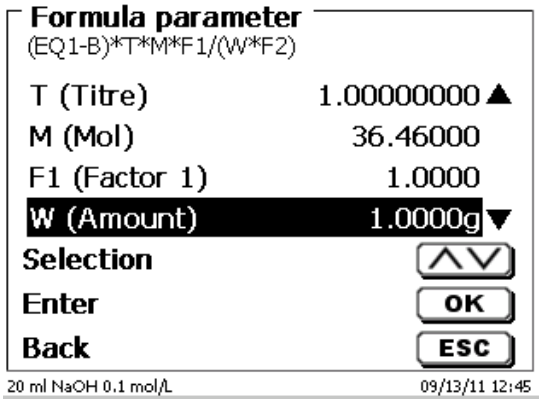

Fig. 116

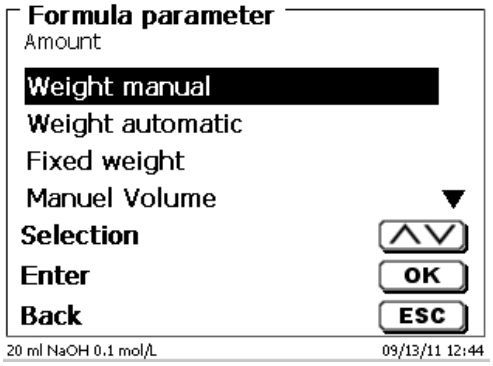

Fig. 117

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

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.

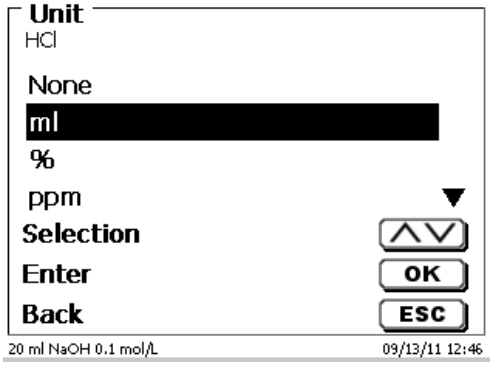

Fig. 118

Once the selection made (e.g. %), the unit will also be displayed as piece of information on the display.

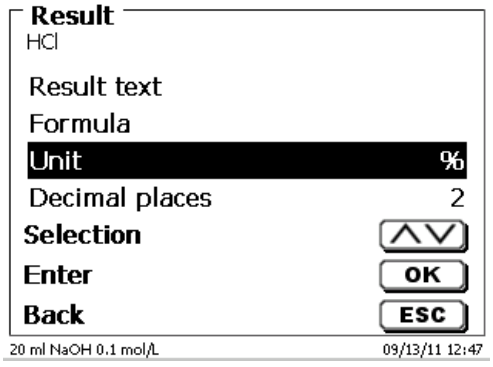

Fig. 119

By pressing the Ins (Insert) key on the external keyboard, you can also add new units

4.6.3.4 Formulae for the Preparation of Solutions

A selection of special calculation formulae is available for the Prepare Solutions mode.

The appropriate calculation formula is selected on the "**Formula Selection"** submenu

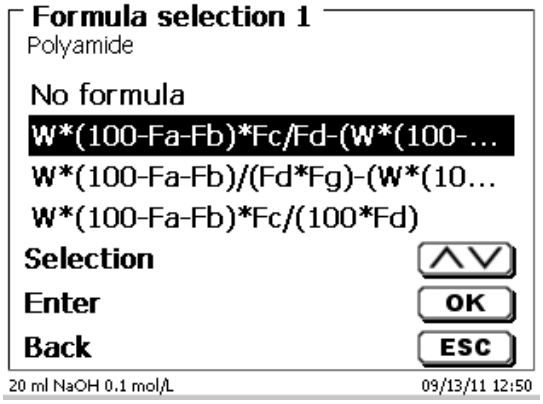

Fig. 120

A selection of 3 different calculation formulae is available:

W*(100-Fa-Fb)*Fc/Fd - W*(100-Fb)/(100*Fe) +Ff

W*(100-Fa-Fb)*(Fd/Fg) - W*(100-Fb)/(100*Fg) +Ff

W*(100-Fa-Fb)*Fc/(100*Fd)

Meaning of the individual factors:

W: Weight of the sample in g

Fa: Soluble foreign-matters portion in %

Fb: insoluble foreign-matter portion in %

Fc: Conversion factor for it unit

g/l	= 10
mg/l und ppm	= 10000
g/100 ml	= 1
%	= 1

Fd: Target concentration of the solution to be prepared in g/l, mg/l (ppm), g/100 ml, or %

Fe: Specific weight of the weighed-in sample in g/cm³

Ff: Volume correction in ml. this volume correction is the required surplus dosage for compensating the volume contraction and the specific-weight difference between the sample weight and the solvent (please observe the note on volume correction)

Fg: Specific weight of the solvent used in g/cm³

Note on volume correction:

The user has to decide on a case-by-case basis whether a volume correction is necessary and according to which procedure this correction is to be performed. As a rule, this volume correction may be omitted in the case of solutions with very low percentages of diluted substance.

4.6.3.5 Decimal digits

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

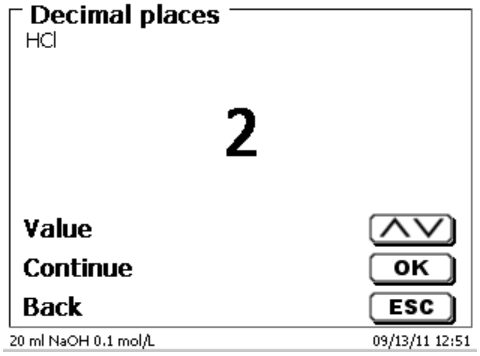

Fig. 121

4.6.3.6 Statistics

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

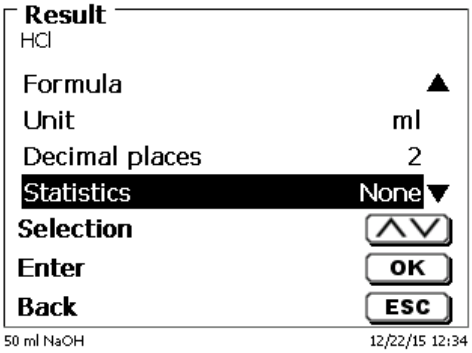

Fig. 122

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. The maximum quantity is 10.

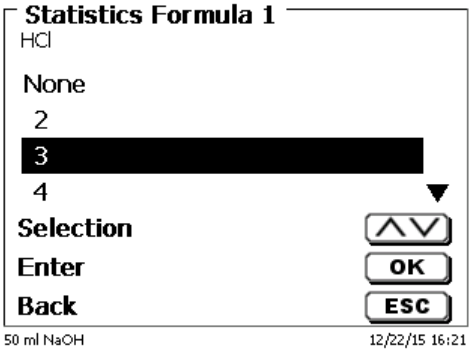

Fig. 123

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

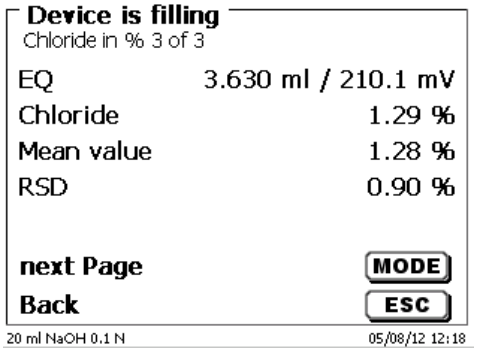

Fig. 124

4.6.3.7 Global Memories

Results of titrations can be written into one of the 50 global memories (M01 - M50) for additional calculations.

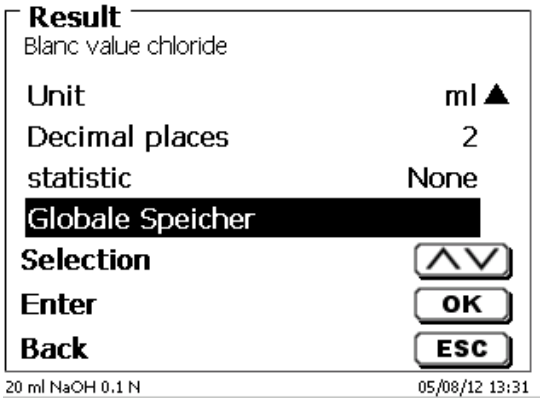

Fig. 125

The mean value is written into the global memory when the statistic is switched on. You enter the submenu with <**Enter/OK**>. If a global memory has not been created, a memory can be created by using the insert key <**Ins**>. The titrator proposes a memory name, such as **M01** (M01 - M50). The name of the memory can be changed in reference to the application. Here in this example of **"M01"** for **"blank value"**.

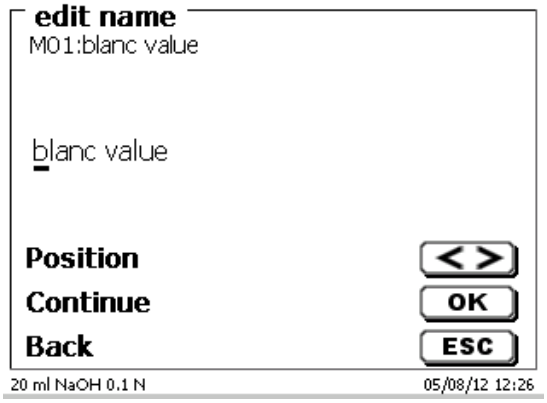

Fig. 126

This simplifies later the allocation of the global memory in another method.

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". The blank value is then automatically deducted from the titrant consumption within the chloride method.

Here in our example, it is 0.013 ml:

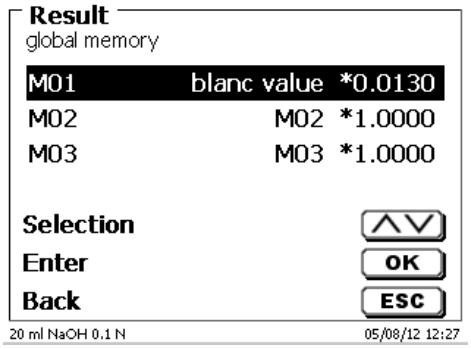

Fig. 127

The menu for the global memory can always be accessed by pressing <**Shift+F5**> or via system settings. The name or values can be changed by using <**EDIT/F3**> and have the methods shown that are used in the global memories.

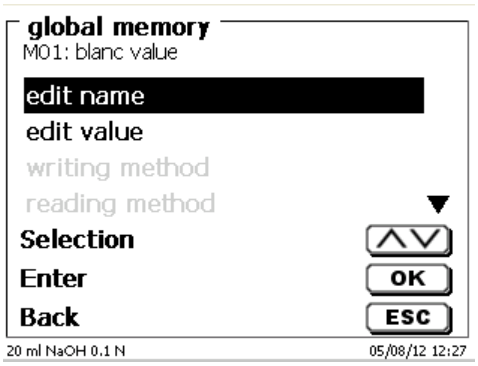

Fig. 128

4.6.4 Titration parameters

The <**Titration parameter**> submenu is used to determine the actual parameters of the method:

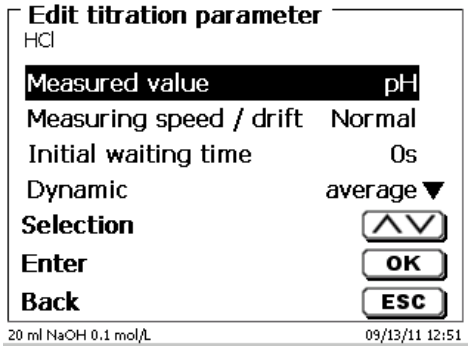

Fig. 129

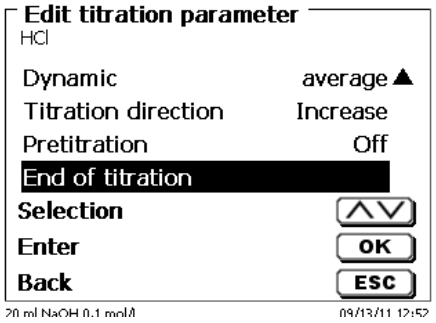

Fig. 130

4.6.4.1 Generally applicable titration parameters

Depending on the titration mode (dynamic, linear, end-point titration, Dead-stop titration and pH Stat titration), it is possible to enter a variety of parameters.

The following parameters are valid for all automatic titration modes:

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

But please note that the measurement speed and the titration end differ again as a function of the respective titration mode. <**Measured value**> is the first selection to be made. In the present example, the selection is “pH“.

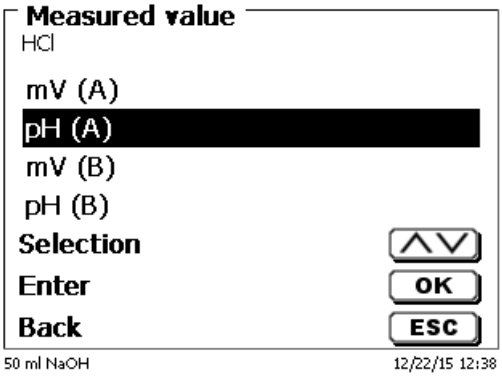

Fig. 131

The selected measured value is displayed for information:

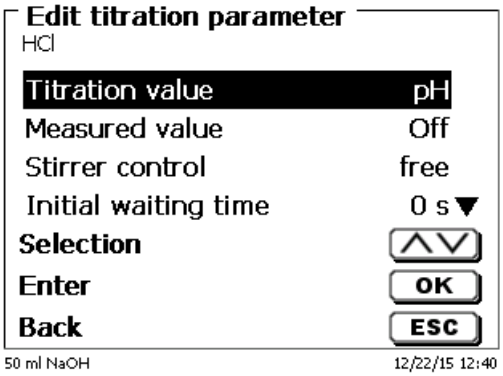

Fig. 132

< **Measuring speed**> or drift will determine the span of time after which the measured value will be accepted following a titration step:

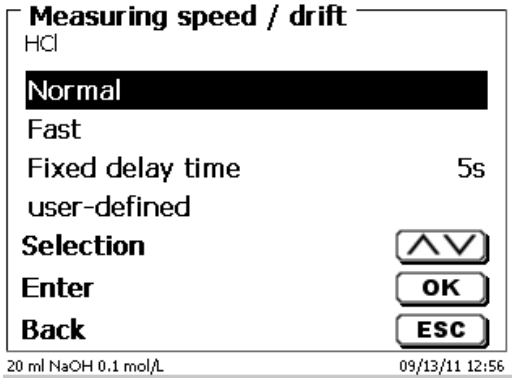

Fig. 133

Drift-controlled acceptance of the measured value in terms of mV/min is set by selecting “**normal**“, “**fast**” or ”**user-defined**”.

a) 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”

b) 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

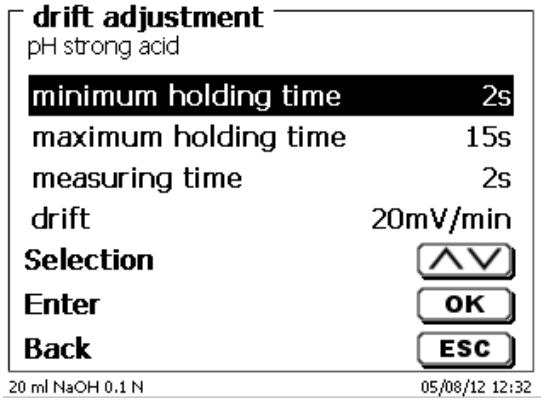

Fig. 134

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:

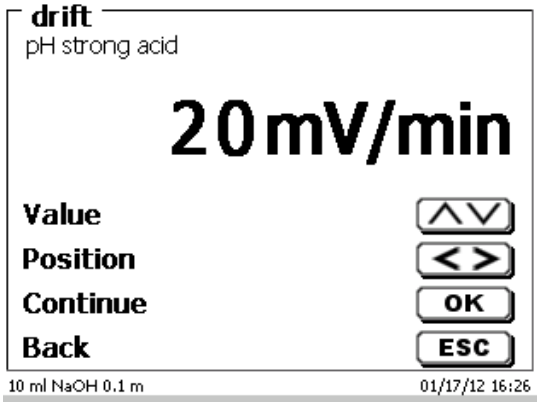

Fig. 135

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:

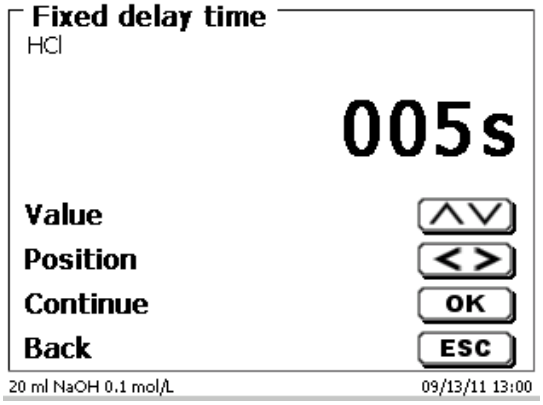

Fig. 136

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:

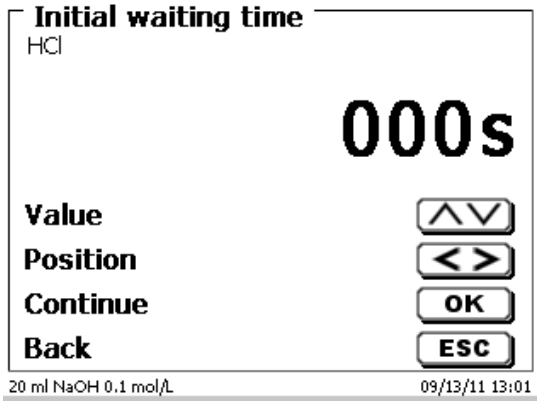

Fig. 137

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

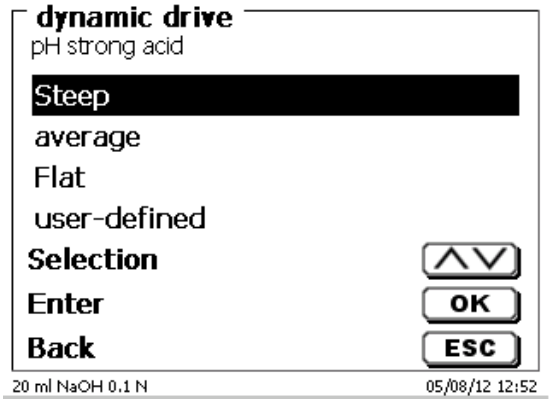

Fig. 138

Dynamic parameters	Min./max. step size	Applications
Steep	0.02/1.0	Strong acids and alkali (HCl, NaOH, HNO3 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

The **adjustable dynamics parameters** can be select:

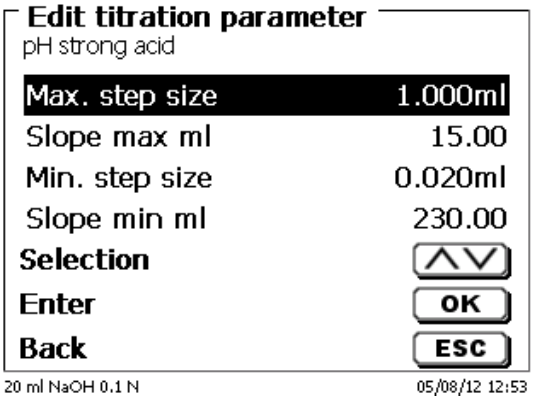

Fig. 139

4.6.4.3 Attenuation setting

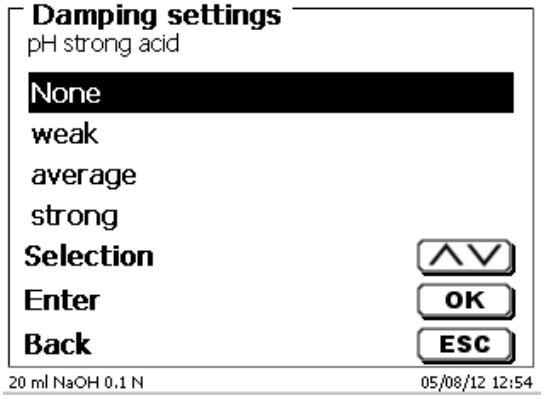

Fig. 140

The pH or mV signal becomes essentially quieter after a specific setting period when the attenuation is switched on (**low**, **medium** or **strong**). A minimum waiting period should therefore also be observed for the various attenuation settings.

Attenuation setting	Minimum waiting period	Application
None	1 second	All aqueous titration applications
Weak	2 - 3 second	Titrations in polar solvents such as ethanol
Average	3 - 4 second	Titrations in partially nonpolar solvents of ethanol/toluene
Strong	5 second or more	Titration in non-polar solvents or harsh applications such as TAN

4.6.4.4 Linear titration

If linear titration control was selected, you have to define the step size.

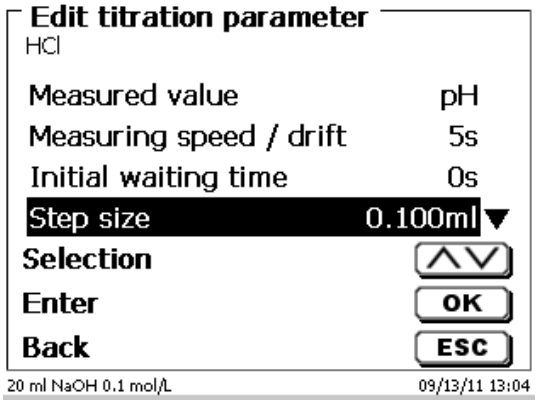

Fig. 141

Linear step size can be set from 0.001 to 5.000 ml.

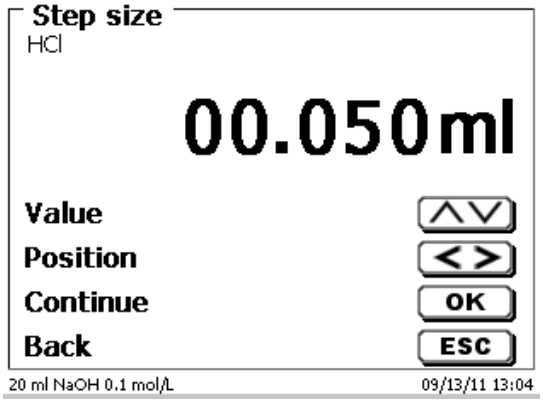

Fig. 142

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.

4.6.4.5 Titration direction

The titration direction can be set to “**increase**“ or “**decrease**“.

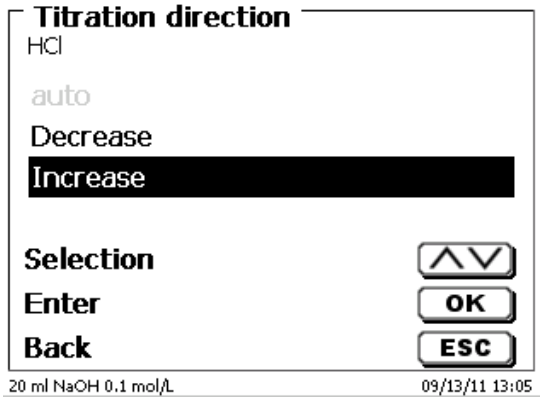

Fig. 143

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

4.6.4.6 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:

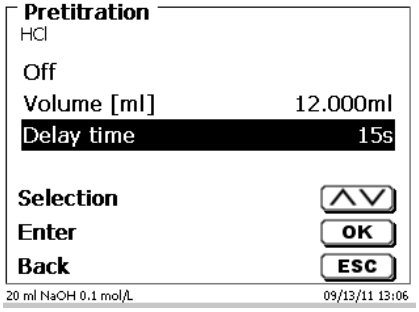

Fig. 144

4.6.4.7 Titration end

The end of a titration is reached, and the result will be calculated as soon as, if

- the defined **End value** pH, mV µA value has been reached
- the criteria (steep, flat, **slope value**) have been met for one turning point (EQ1) or two turning points (EQ2) 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.

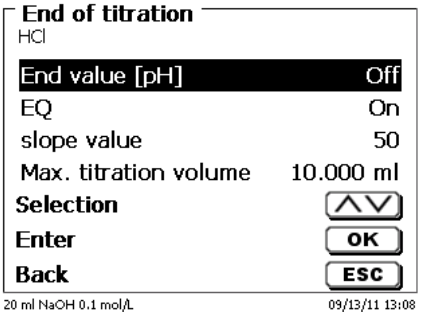

Fig. 145

It is also possible to switch off the criteria for the end value for pH and mV.
This value cannot be switched off in the case of a µA (Dead Stop) titration!

The possible pH end value input ranges from 0.000 to 14.000.
The possible mV end value ranges from -2000 to +2000.
The range of the µA input can be selected between 0.0 and 100.0.

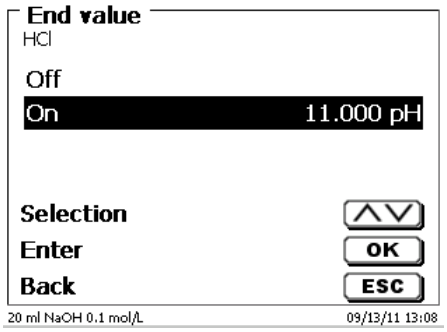

Fig. 146

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

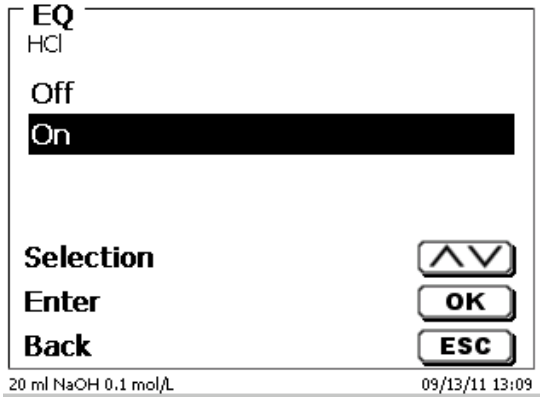

Fig. 147

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:

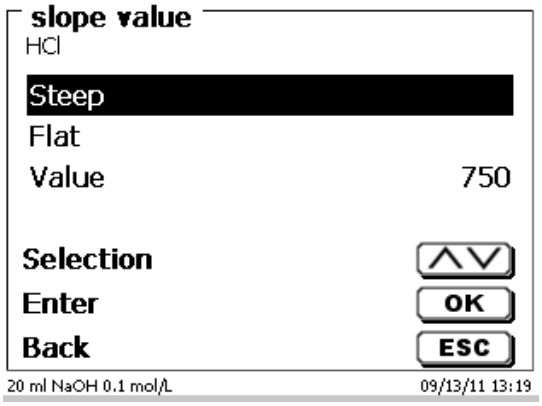

Fig. 148

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. The slope value (dmv/dml) can be read on the printout. It is put between brackets to the right of the EQ value.

D Setting of the **maximum titration volume** 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 und 999.999 ml:

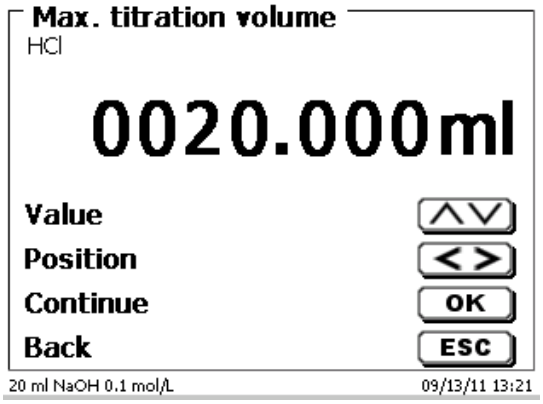

Fig. 149

4.6.5 „End-point titration" and "dead-stop titration- titration parameters

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

As was already described in 🕮 **Chapter 4.5.2.3**, end-point titration, in a first stage, proceeds by continuously dosing until a specific Delta value ("**Delta end-point**") 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 **end-point delay**.

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:

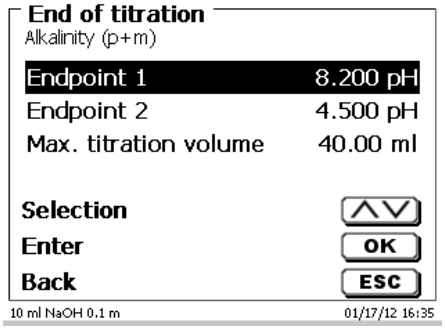

Fig. 150

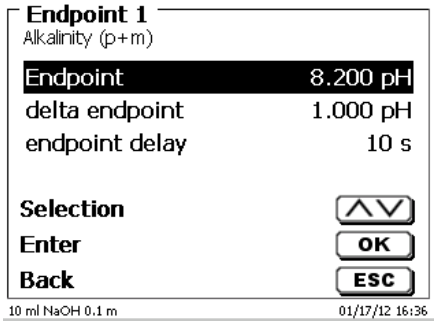

Fig. 151

Dead-Stop Titration and Polarization voltage
Polarisation voltage in mV can only be set for dead stop titration.

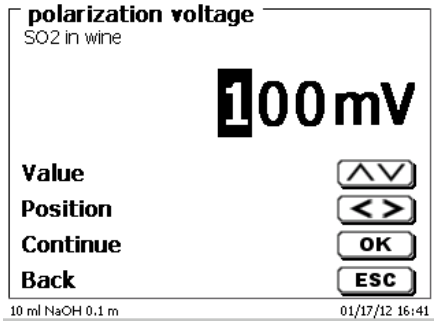

Fig. 152

The values can be set between 40 and 220 m. The pre-setting is 100 mV.

Low polarisation voltage: insensitive
High polarisation voltage: sensitive

4.6.6 Titration parameter pH Stat Titration

Explanatory Notes for the pH Stat titration, see also 🕮 **Chapter 4.6.2.4**.

The titration parameters for the first Level (titration level) are already described in detail in the endpoint titration. The other settings for the pH Stat titration are carried out in the sub-menu End of titration/Measuring settings.

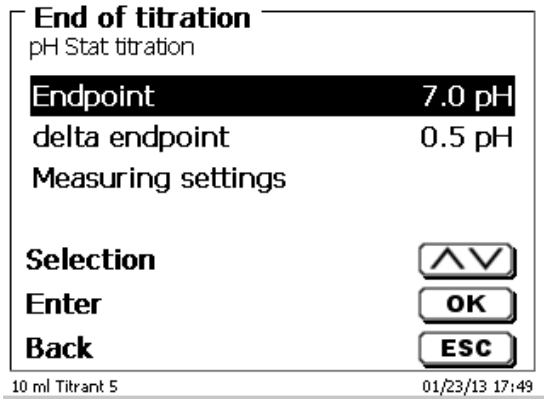

Fig. 153

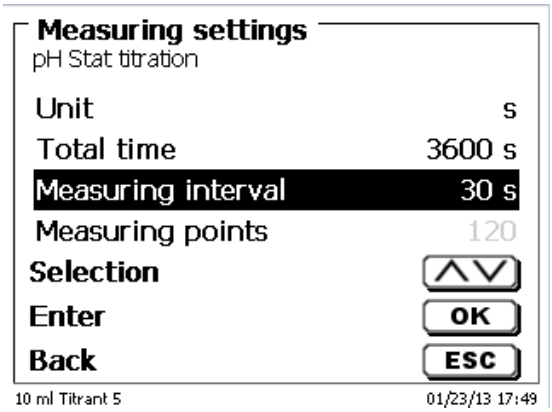

Fig. 154

Depending on the application and duration, the time unit is defined in second, minute or hour.

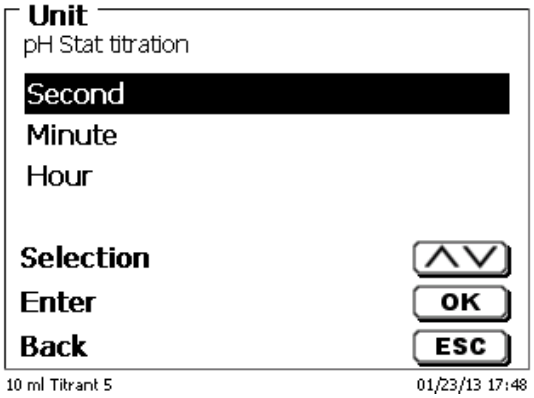

Fig. 155

For example, measurements can be entered in seconds up to 2 hours.

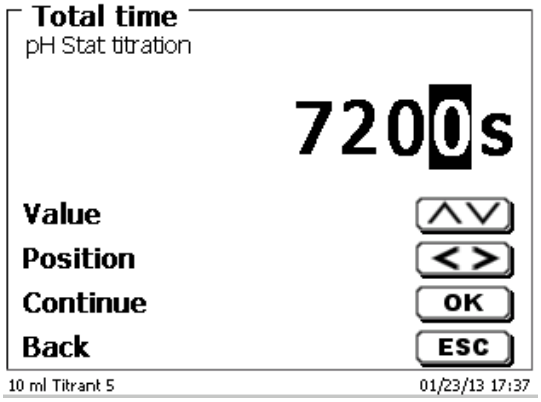

Fig. 156

With a measuring interval of 60 seconds, that would be a total of 120 readings.
Up to 1000 measuring points can be recorded for a pH-stat titration.

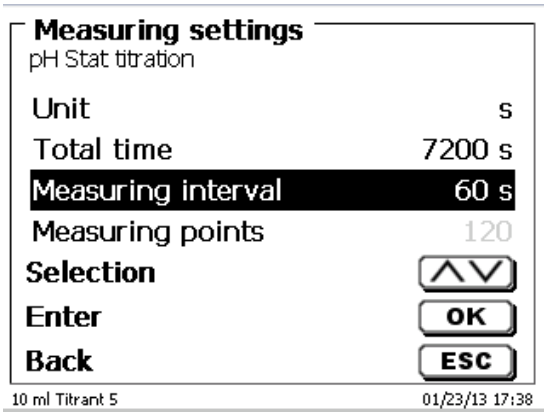

Fig. 157

Even if the measuring interval is set to 60 seconds, or 5 hours, the pH value is still maintained constant over the entire period. The number of measured values does not affect the titration control.

Determination of Enzyme Activity

The enzyme activity is a measurement of the number of substrate molecules, which converts an enzyme per second. The H^+ ions produced during the reaction are thereby titrated with the NaOH solution. Then the slope formula is selected to calculate the slope in ml/s:

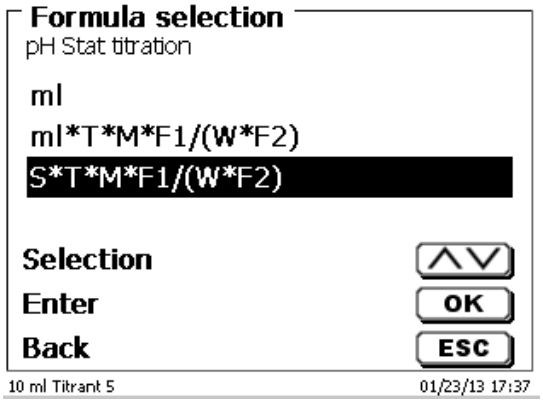

Fig. 158

The evaluation window can be used to calculate the slope by entering the start time and duration (Time period):

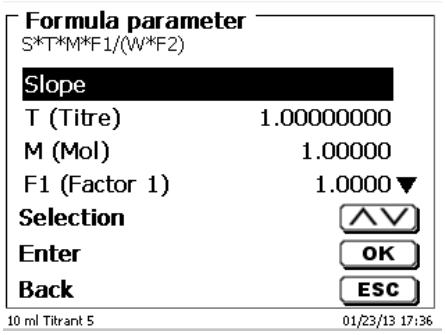

Fig. 159

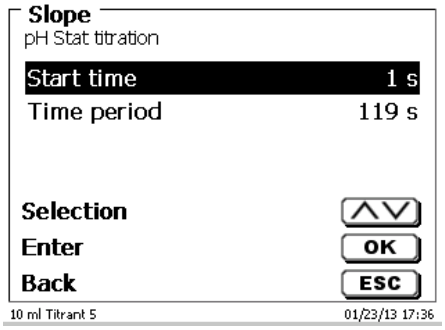

Fig. 160

The start time and the time period are set automatically during parameterization of the total duration.

However, it is possible to enter a different start time and time period. However, no time period > can be entered as the total time. If it is necessary to increase the Start time, the Time period must also be changed.

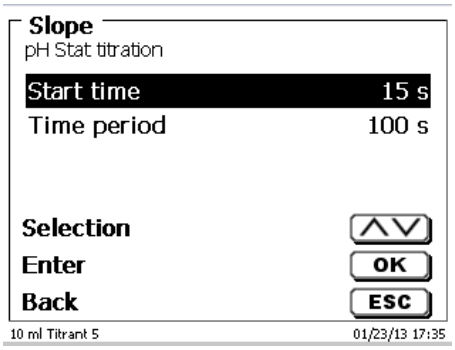

Fig. 161

The start time always begins when the desired pH is reached. If, for example, the target pH is reached after 25 seconds, and the start time is 15 seconds, the evaluation begins at 40 seconds.

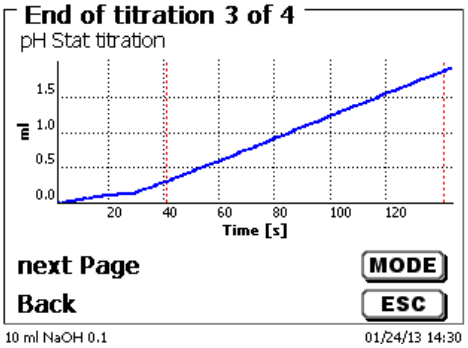

Fig. 162

4.6.7 Dosing parameter

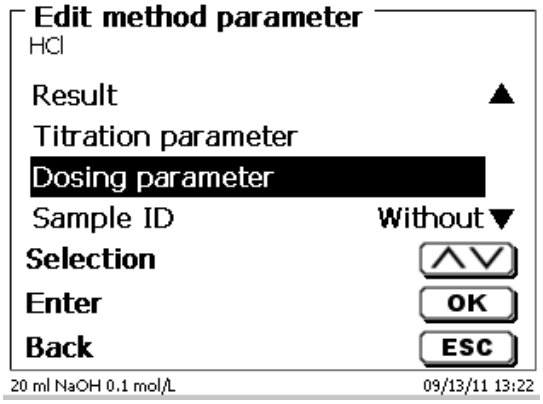

Fig. 163

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.

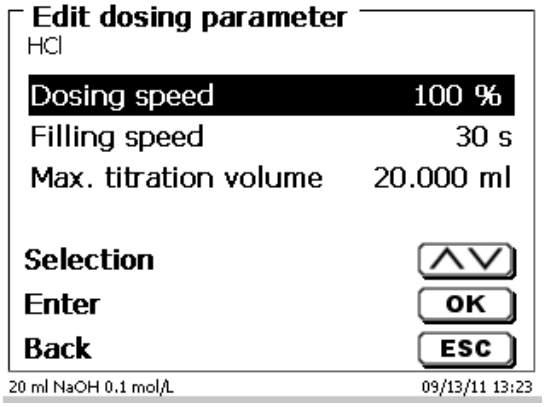

Fig. 164

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

Interchangeable unit	Max. dosing speed [ml/min]
WA 05	10
WA 10	20
WA 20	40
WA 50	100

The filling speed can be set in terms of seconds from 20 to 999.

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:

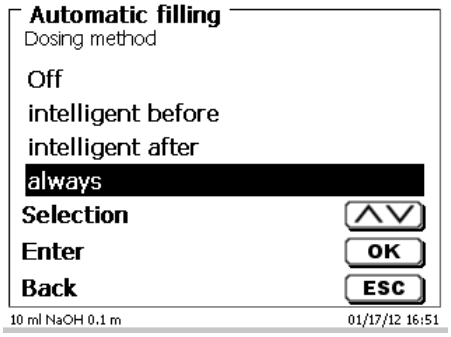

Fig. 165

„**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.

4.6.8 Sample identification

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

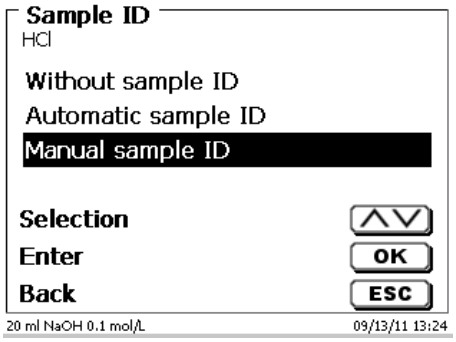

Fig. 166

For a sample description of the ’**manual’**, a prompt for the sample description will always be displayed at the start of the method (Cp. also 🕮 **Chapter 3.6**, **Main menu**).
For an ‘**automatic**’ sample description there will be selected a master description (in the current case this is water, cp. Fig. 107), which will then automatically be numbered starting on 01.

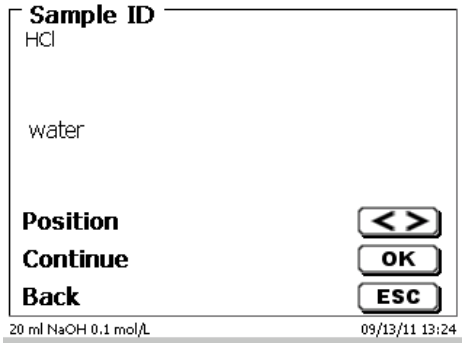

Fig. 167

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

4.6.9 Documentation

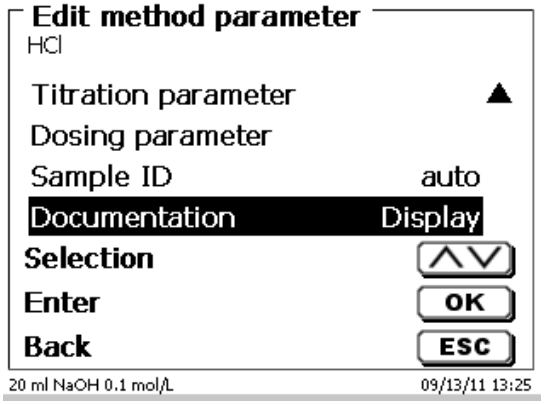

Fig. 168

Three different format settings are available for documentation on a printer or USB device: "**short**", "**standard (with curve)"** and "**GLP**":

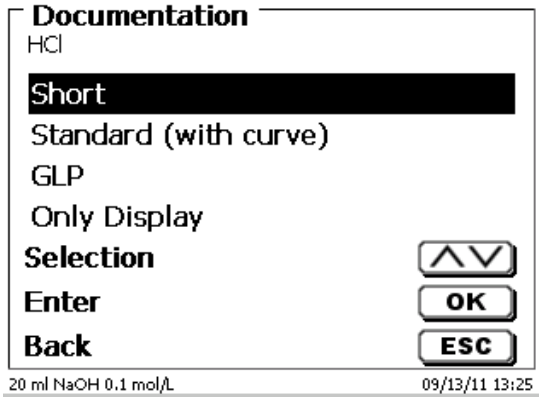

Fig. 169

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	Methodenname, Datum, Uhrzeit	N/A	Same as 'Short documentation' + plus method contents
Prepare solutions	Method name, date, time, sample designation, weight/sample, results and calculation formula	N/A	Same as 'Short documentation' + plus method contents
Measure single	Method name, date, time, sample description, result	N/A	Same as 'Short documentation' + plus method contents
Continuous measurement	Method name, date, time, sample description, result	N/A	Same as 'Short documentation' + plus method contents

4.7 Method parameters of the KF-Titration

4.7.1 Standard methods of KF

If no titration has been performed yet, it is recommended to load one of the standard methods. These methods have default parameters and can generally be used immediately without changes. From the main menu, press <**F3**/**EDIT**> to access the methods menu.

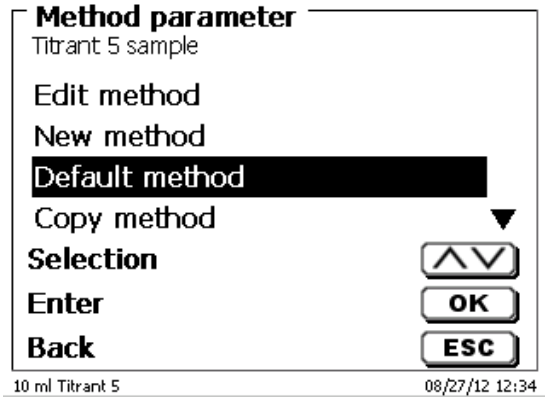

Fig. 170

From this menu, select the appropriate standard method
Here is an overview of the standard methods for KF titration:

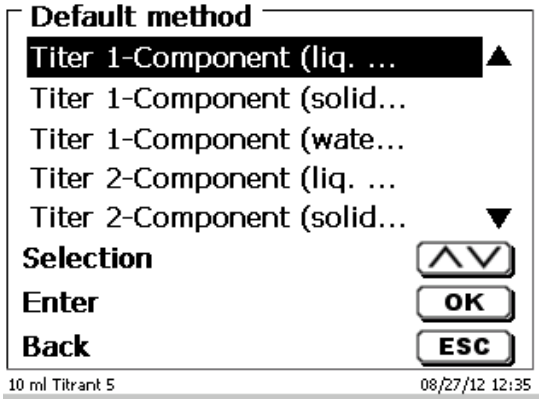

Fig. 171

Standard methods KF	Application
Titer 1-Component (liquid standard)	Determination of the concentration of the titration agent. Suitable for 1-component reagents. Standard is a liquid standard in ampoules with a concentration of 10 mg/g.
Titer 1-Component (solid standard)	Determination of the concentration of the titration agent. Suitable for 1-component reagents Standard is the standard substance sodium tartrat dihydrate with a water amount of 15.66 %.
Titer 1-Component (water)	Determination of the concentration of the titration agent. Suitable for 1-component reagents Standard is pure water
Titer 2-Component (liquid standard)	Determination of the concentration of the titration agent. Suitable for 2-component reagents. Standard is a liquid standard in ampoules with a concentration of 10 mg/g.
Titer 2-Component (solid standard)	Determination of the concentration of the titration agent. Suitable for 2-component reagents Standard is the standard substance sodium tartrat dihydrate with a water amount of 15.66 %.
Titer 2-Component (water)	Determination of the concentration of the titration agent. Suitable for 1-component reagents Standard is pure water
Sample 1-Component	Method for sample titrations with 1-component reagents
Sample 2-Component	Method for sample titrations with 2-component reagents

Statistics are switched on. The mean value of the titer in mg/ml is automatically saved in the attachment.
It is then used automatically in the sample titration.

The results of the sample titration are calculated in %.
If needed, the unit can be converted into other units of measure, such as ppm.

KF titration is a specific form of dead-stop titration.
In normal dead-stop titration, titration is to the specified value in µA, which must be maintained for a defined time.
In KF titration, this still occurs, but a specified drift criterion in µg/min must also be met. With KF titration, a conditioning step is also is preset in order to eliminate any moisture in the titration vessel and the solvent.

The first stage of the Dead stop and KF 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 with linear step sizes between the delta value and the end point.

The following titration parameters can be set for the dead-stop and KF titration:

Titration parameter	Dead-stop titration	KF titration
µA-Endpoint	X	X
Delta µA-value	X	X
Linear steps in ml	X	X
Endpoint delay in s	X	X
Delay time (between linear steps)	X	X
Start delay time /extraction time	X	X
Conditioning on/off	-	X
Pre - titration in ml	X	X
Polarization voltage in mV	X	X
Minimum und maximum titration time in s	-	X
Max. titration volume	X	X
Drift in µg/min	X	X
Dosing speed in %	X	X

4.7.1.1 Calculation Formula KF-Titration

The appropriate calculation formula is selected on the **Formula selection** submenu.

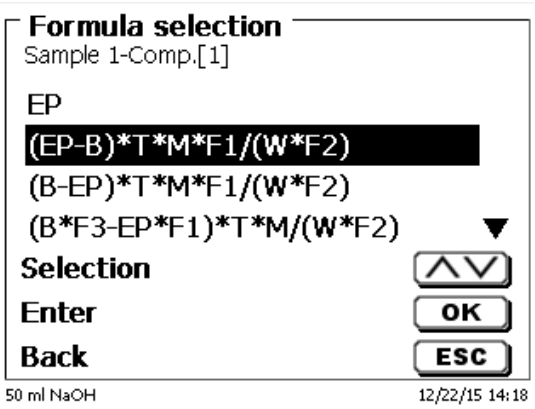

Fig. 172

The following calculation formulae are available for automatic titration mode:

Formula	Additional information
EP	Formula for calculating only the ml consumption
(EP-B)*T*M*F1/(W*F2)	Formula for calculating the concentration of a sample taking into account a blank value in terms of ml
(W*F2)/(EP-B)*M*F1)	Formula for calculating a titer (T) of a titration solution

The abbreviations used here are identical to the other kinds of titration (see also 🕮 **Chapter 4.6.3.1**).

4.7.2 KF Titration parameters

The <**Titration parameter**> submenu is used to determine the actual parameters of the method.
The parameters were already introduced in 🕮 **Chapter 4.6**.

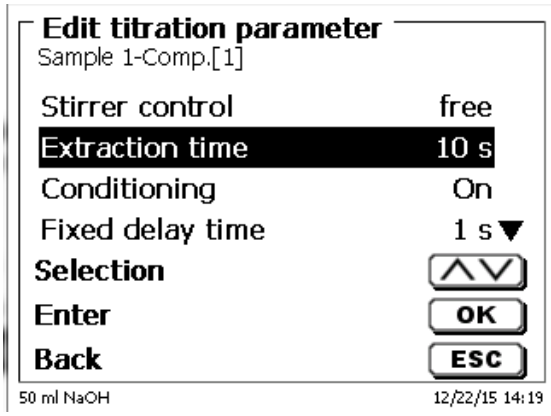

Fig. 173

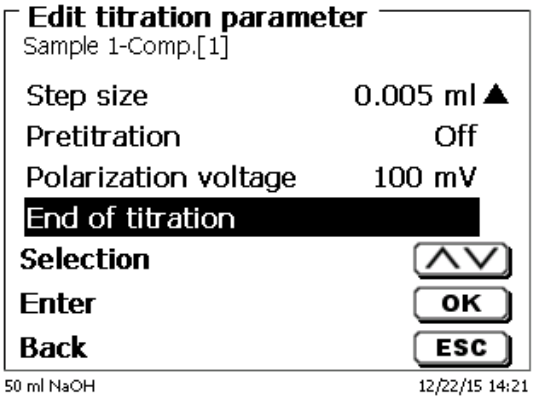

Fig. 174

Generally applicable titration parameters

Depending on the titration mode (KF or dead stop titration) it is possible to enter a variety of parameters.
The following parameters are valid for the KF titration mode:

- Initial waiting time
- Conditioning
- Fixed delay
- Step size
- Pretitration
- Polarization voltage
- End of titration

a) Start delay time/Extraction time (KF)

With dead-stop titration, the start wait time passes at the beginning of titration.
In KF titration, the start wait time = the extraction time.
The extraction time ends after the sample is supplied.
The start wait/extraction time can be specified between 0 and 999 seconds.

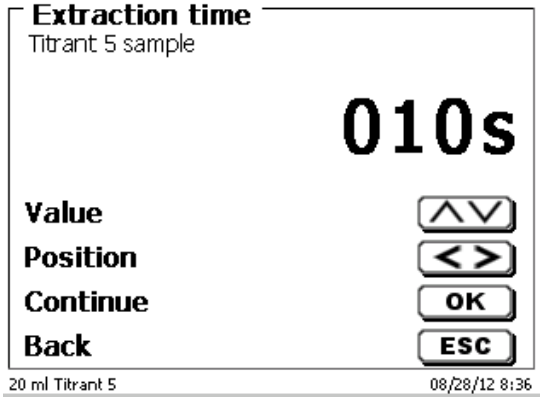

Fig. 175

b) Conditioning

Conditioning (only KF) is activated for every KF method.
It can be shut off via a PC for external control.

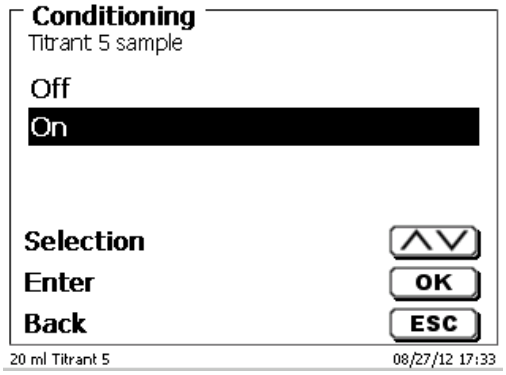

Fig. 176

c) Fixed delay time

The fixed delay time is the waiting time between the linear titration steps at the end of the titration until the Endpoint. The fixed delay time can be set between 0 and 999 seconds

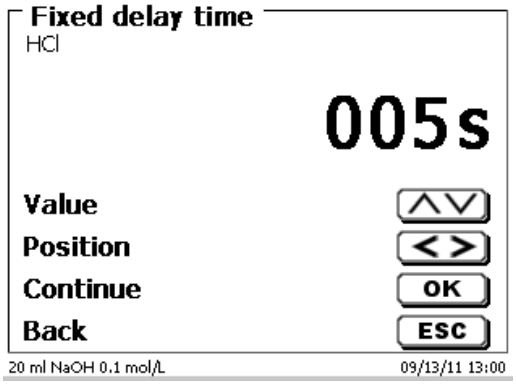

Fig. 177

d) Step size

The step size can be set from 0.001 to 5.000 ml.
Typical value for the KF titration are 0.002 – 0.01 ml.

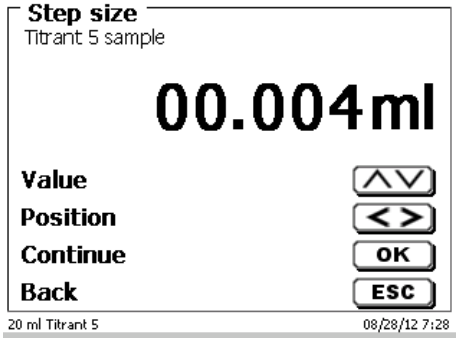

Fig. 178

In this type of titration, linear step width is used after the continuous titration stage.

e) Pretitration

If the titration agent consumption is roughly known, you can set a pretitration volume on the <**Pretitration**> menu. 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.

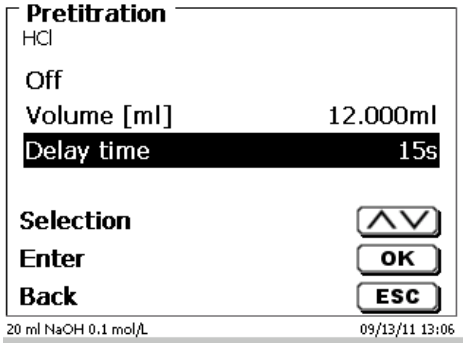

Fig. 179

f) Polarization voltage

Polarisation voltage in mV can be set for KF and dead stop titration.

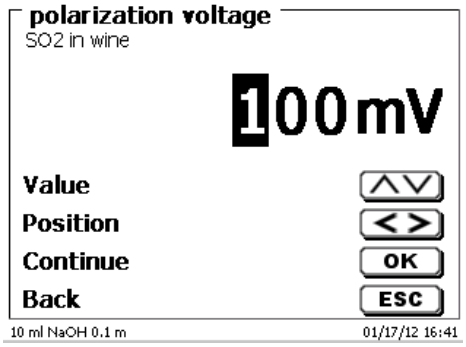

Fig. 180

The values can be set between 40 and 220 m. The pre-setting is 100 mV.

Low polarisation voltage:	insensitive
High polarisation voltage:	sensitive

g) Titration end

The end of a titration is reached, and the result will be calculated as soon as, or if, respectively:

- The defined **End value** in µA value has been reached
- The Endpoint delay in seconds has been adhered
- The drift value in µg/min has been reached
- The predefined value ml has been reached (**Maximum titration volume**)
- The conditions for **minimum** and **maximum titration time** are maintained

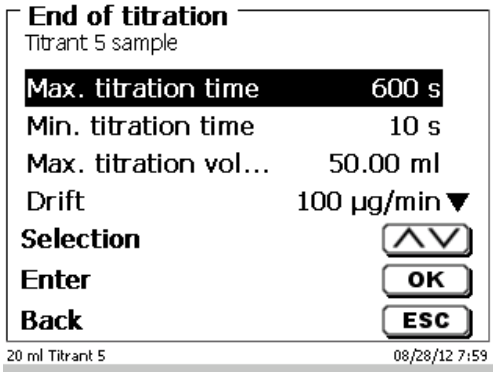

Fig. 181

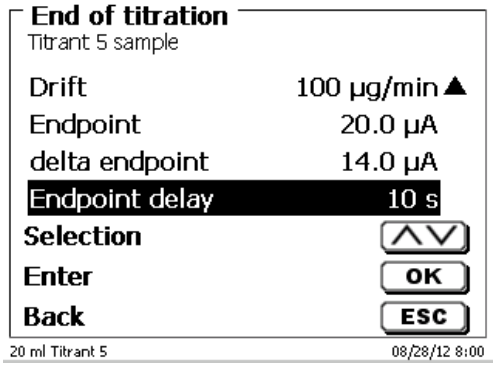

Fig. 182

Maximum titration time

Can be set between 0 - 9999 seconds.

The default setting is 600 seconds. The maximum titration time is generally used for KF titration, which can create a high continuous drift from a secondary reaction and thus cannot reach a stable endpoint.

Minimum titration time

Can be set between 0 - 9999 seconds. The default setting is 10 seconds.

The minimum titration time prevents premature termination of the titration if there is a delay in the extraction of water from the sample. The minimum titration time is used in combination with the extraction time. It expires while the extraction time is still active.

Maximum titration volume

Setting should always make sense.
The maximum titration volume can be set between 1.000 und 999.999 ml.
The volume for conditioning is included in the count!

It also serves as a safety criteria to prevent excessive titration, i.e. a possible overflow of the titration vessel.

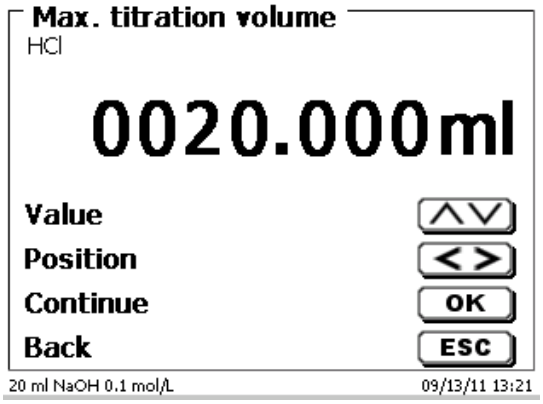

Fig. 183

Drift

The drift is calculated in µg/min from the titration mean consumption/time x concentration of the titration solution.

A stable drift at the beginning and end of the titration is important if you want to obtain reproducible results. This applies in particular to samples with low water content in the bottom percentage range (<0,1%). The drift value should also not be set too low because the titration time will increase considerably.

An airtight and dry titration vessel has a drift of < 50 µg/min. This corresponds to consumption of 10 µl (0,01 ml) of titrant at a concentration of 5 mg/ml.

For many applications, a drift value of 100 - 150 µg/min is entirely sufficient. The default drift value setting is 100 or 150 µg/min for sample titration. 50 µg/min is the default setting for titer methods.

Endpoint µA

The range of the µA input can be selected between 0.0 and 100.0.
For KF titration, values between 10 - 30 µA are practical. The standard value is 20 µA.

Delta Endpoint µA

The Delta value in µA is one of the most important parameters for KF and dead-stop titration.

The lower the Delta value is, the longer the titration (dosing) is at a continuous speed. When using single-component reagents and pure methanol as a solvent, the Delta value should be set at < 5 µA.
Values of 2 or 3 µA are practical. This is because the KF reaction in methanol runs relatively slowly.
When using double-component reagents or also when using combination solvents,
the Delta value must be set at > 10 to prevent rapid overtitration. Values of 14 or 15 µA are practical.

Endpoint delay

The endpoint delay is set in seconds. It can be set from 0 - 100000 seconds.
The standard value is 10 seconds. Brief endpoint delays (5 seconds) are practical when

- using very small increments (e.g., 0,001 ml)
- using a titer of 1 mg/ml
- creating a secondary reaction with a higher drift value

4.8 Measuring method

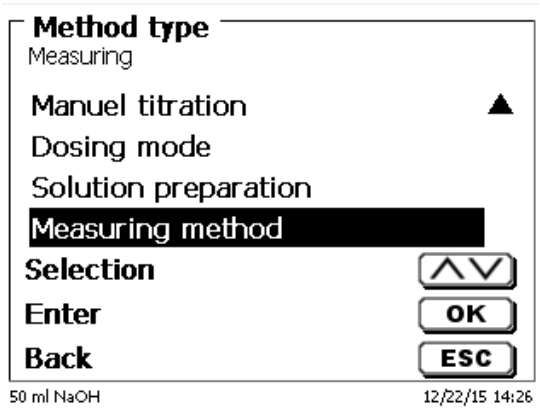

Fig. 184

In the measuring method pH, mV and conductivity values can be added individually or continuously

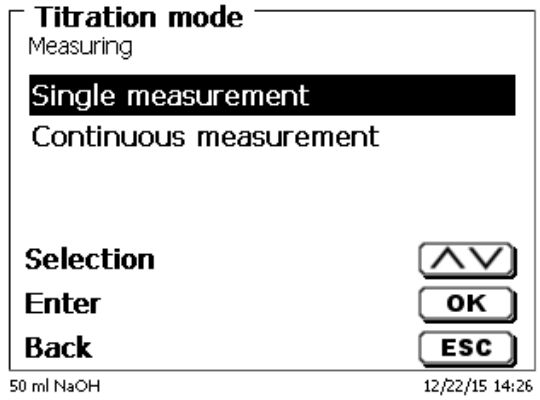

Fig. 185

Since the 7800 TitroLine® features two measurement inputs, two parameters can be measured simultaneously and recorded. The measured value is then displayed value during a continuous measurement. The 2nd measured value is only recorded and each of the start and end values displayed:

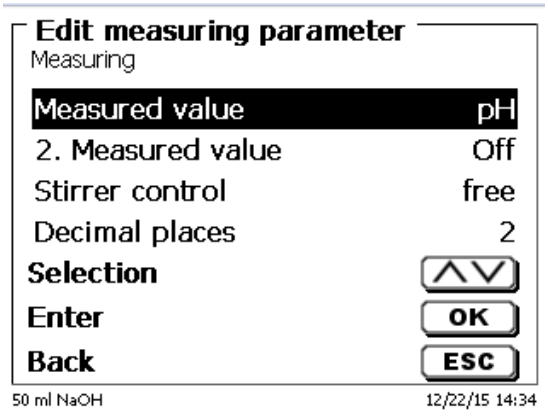

Fig. 186

If you choose only 2. Reading the conductivity (µs/cm)

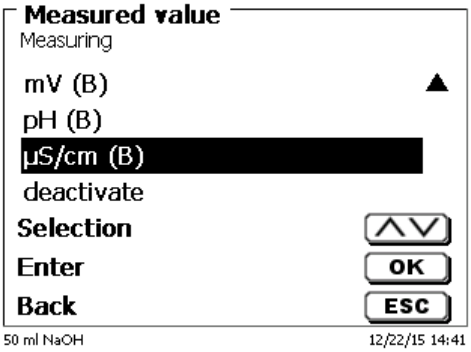

Fig. 187

you can adjust the corresponding parameters of the conductivity measurement as the nonlinear (nLF) or linear temperature compensation

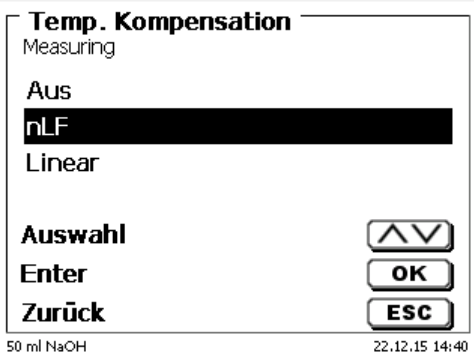

Fig. 188

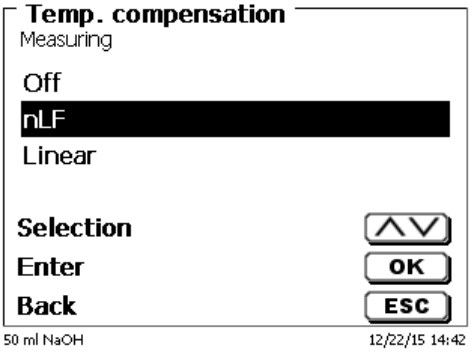

Fig. 189

In the non-linear temperature compensation you can adjust the reference temperature of 25 ° C (standard) and 20 ° C

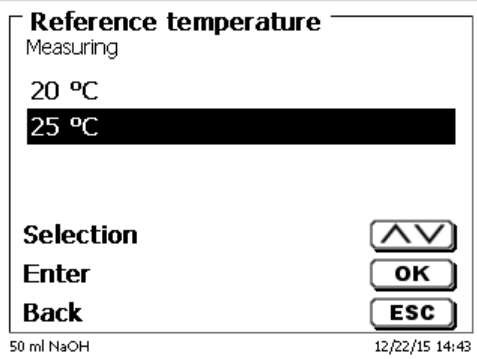

Fig. 190

In the linear temperature compensation you can adjust the temperature coefficient of 2.0000 1 / K for the natural waters to other solutions

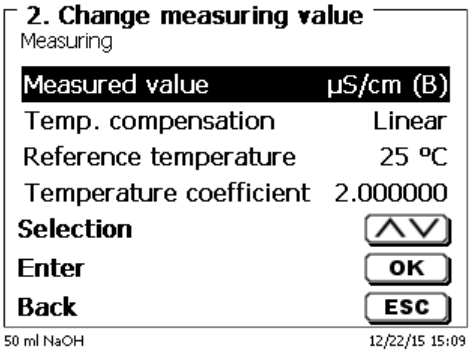

Fig. 191

The measurement speed (drift, etc.) and the damping can be adjusted as usual

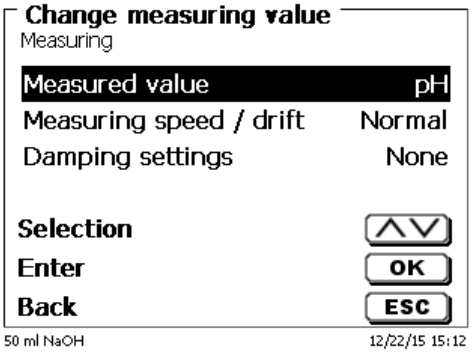

Fig. 192

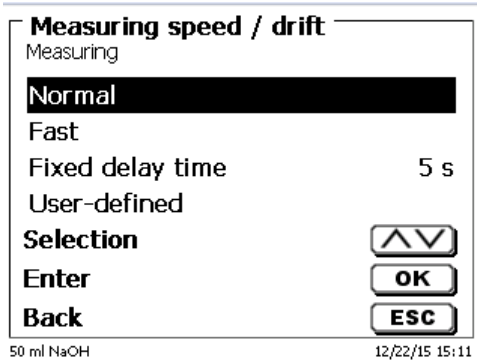

Fig. 193

So the display is shown with two measurement parameters from:

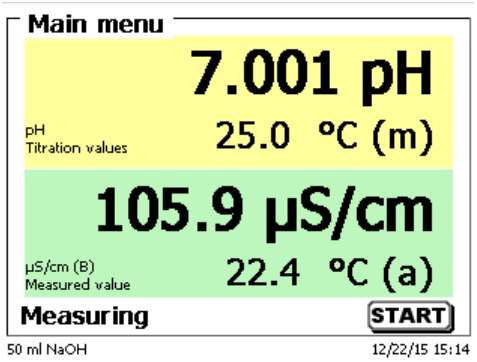

Fig. 194

With continuous measurement the length of the measurement and the measurement frequency / number of measuring points can be additionally specifies

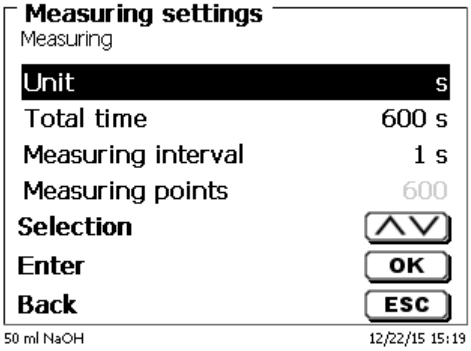

Fig. 195

The measurement curve can be followed in a graph.
The values are stored in connected USB flash drive into a CSV file

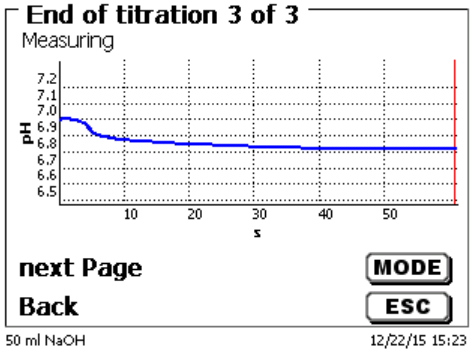

Fig. 196

When measured with one measuring parameter readings see eg like this:

	A	B	C
1	s	pH	°C
2	0.183	6.801	25.0
3	0.374	6.799	25.0
4	1.515	6.799	25.0
5	2.655	6.799	25.0
6	3.798	6.800	25.0
7	4.940	6.799	25.0
8	6.079	6.800	25.0

Fig. 197

In a measurement with two measurement parameters, the measured values, for example, looks like this

	A	B	C	D	E
1	s	pH	°C	µS/cm (2)	°C (2)
2	0.190	6.990	25.0	0.179	22.5
3	0.761	7.014	25.0	0.179	22.5
4	1.902	7.002	25.0	0.235	22.5
5	3.044	6.991	25.0	0.004	22.5
6	4.195	6.972	25.0	0.189	22.5
7	5.333	6.924	25.0	0.370	22.5
8	6.474	6.904	25.0	0.069	22.5
9	7.615	6.890	25.0	0.004	22.5

Fig. 198

5 System settings

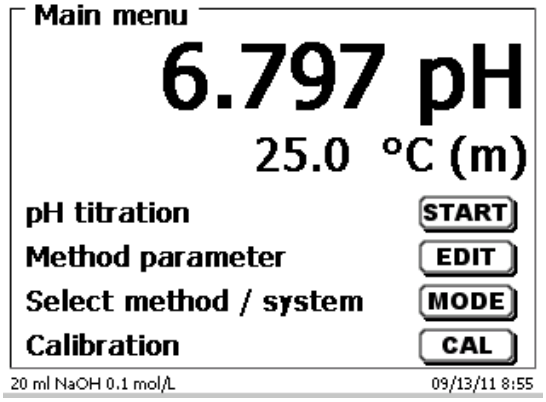

Fig. 199

From the main menu (Fig. 199) <**SYS**>/<**F7**> will get you to the system settings.

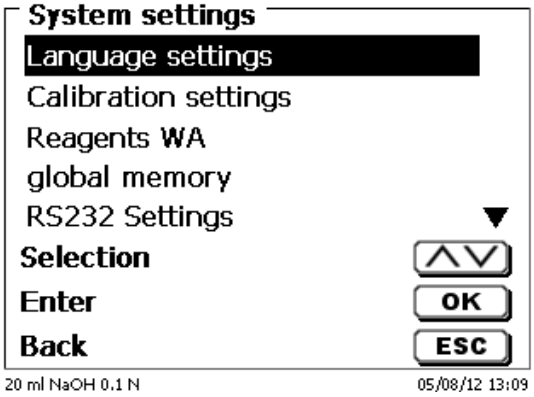

Fig. 200

Setting the national language was already described in 🕮 **Chapter 2.5**.

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

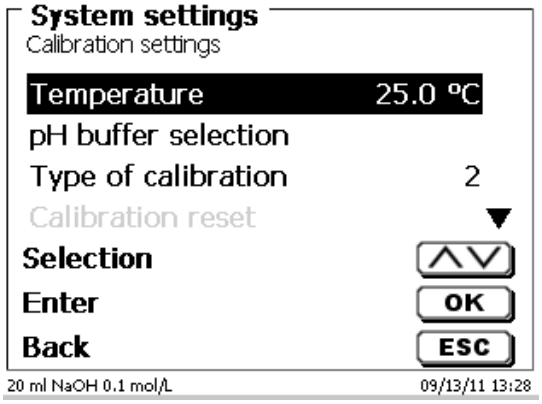

Fig. 201

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

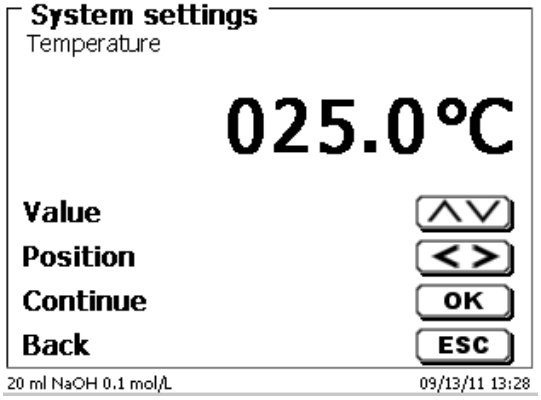

Fig. 202

The type of calibration items is used to define whether a 2-point or a 3-point calibration has to be performed.

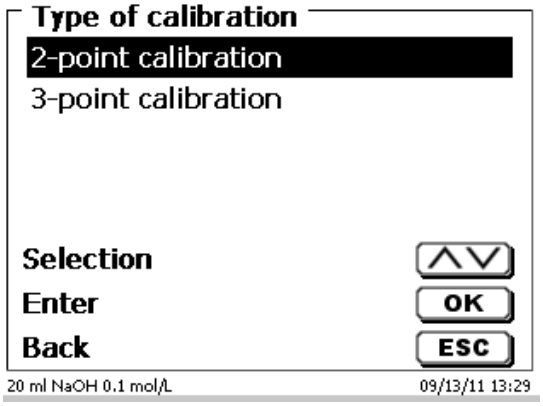

Fig. 203

The pH buffers for the buffers 1 - 3 can be determined individually.

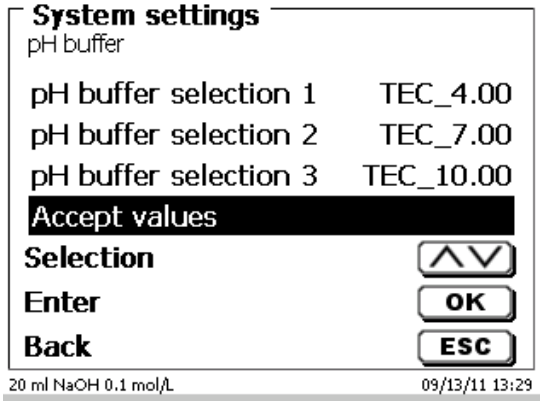

Fig. 204

A list of technical and so-called DIN/NIST buffers will appear.

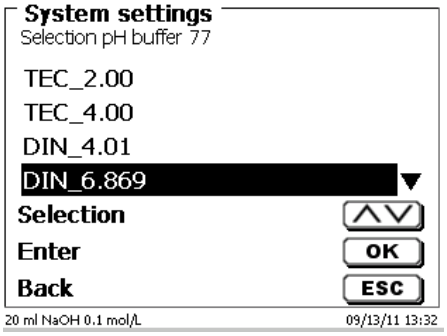

Fig. 205

After having determined the buffers for buffers 1 - 3, 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:

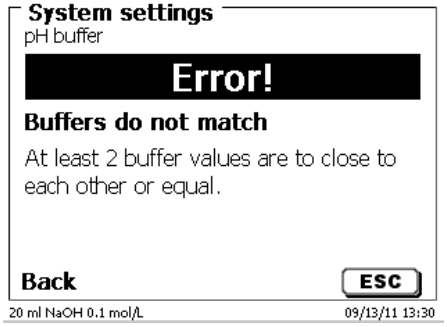

Fig. 206

5.2 Interchangeable Unit - Reagents

Each interchangeable unit is equipped with an RFID transponder. This transponder can be used to store the following information:

- Unit size: (the default setting, cannot be changed)
- Unit ID: (default setting, cannot be changed)
- Reagent name: (default: blank)
- Concentration: (default: 1.000000)
- Concentration determined on: (Date)
- To be used until: (Date)
- Opened/Produced on: (Date)
- Test according to ISO 8655: (Date)
- Charge description: (default: no charge)
- Last modification: (Date)

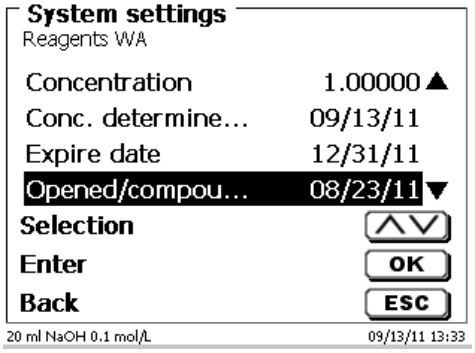

Fig. 207

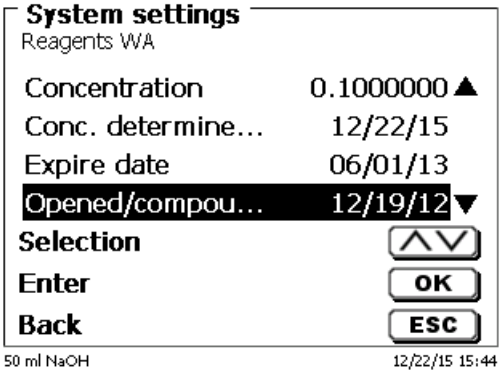

Fig. 208

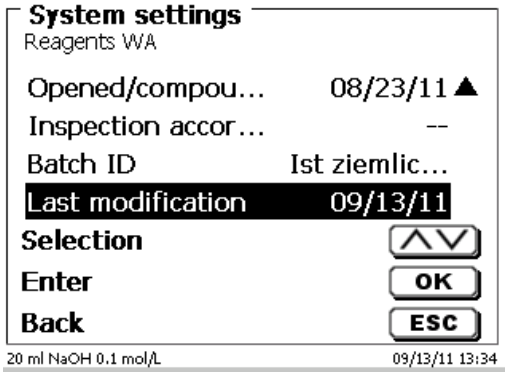

Fig. 209

If you leave the <**Reagenzien WA**> menu using <**ESC**>,
you will always be prompted to know whether you wish to adopt the values:

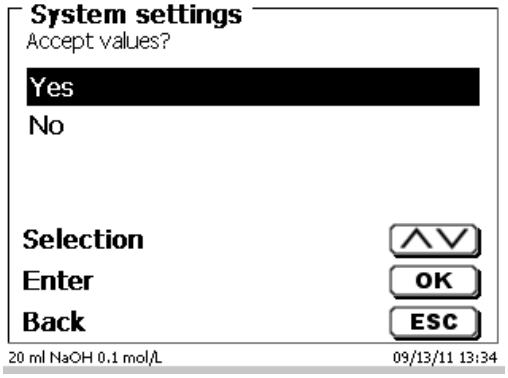

Fig. 210

If <**Yes**> is selected, the updated values will be written into the RFID transponder of the interchangeable unit.

5.3 Electrode menu

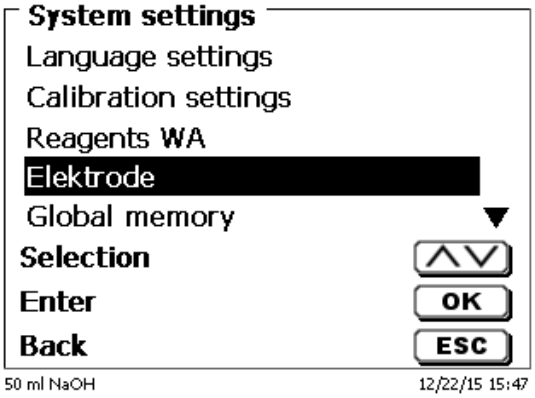

Fig. 211

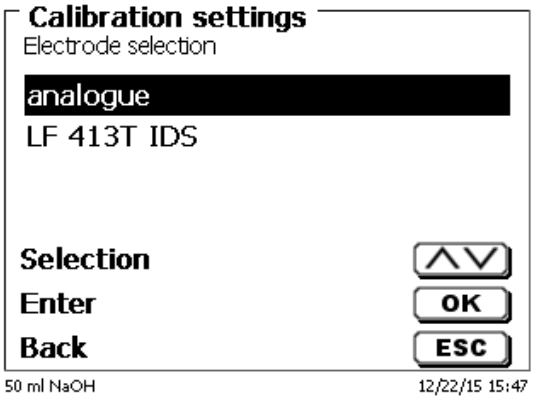

Fig. 212

There are information about the analog pH electrode (slope, zero and time of calibration) and the digital display electrode. It may also be the respective calibration routine to be started.

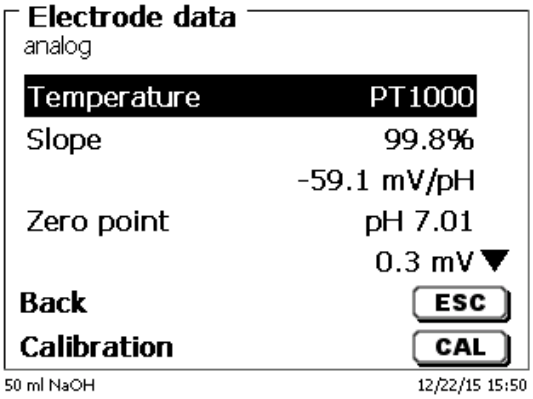

Fig. 213

The type of the temperature sensor can be selected in the analogue electrode type. Type PT 1000 is pre-selected. However, also a temperature sensor with NTC 30 kOhm can be connected.

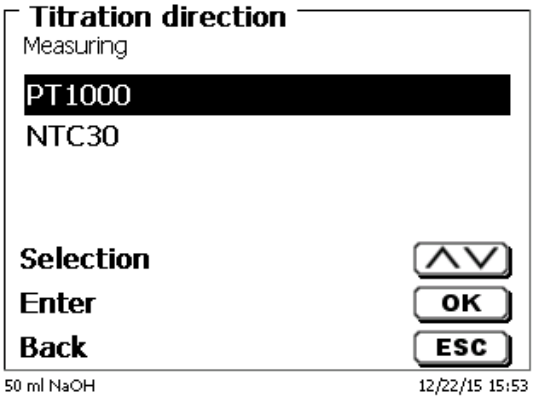

Fig. 214

In a digital electrode of type, batch number, the software version, the calibration of the electrode and the date of the last calibration is stored and displayed.

The data of a conductivity electrode looks like this

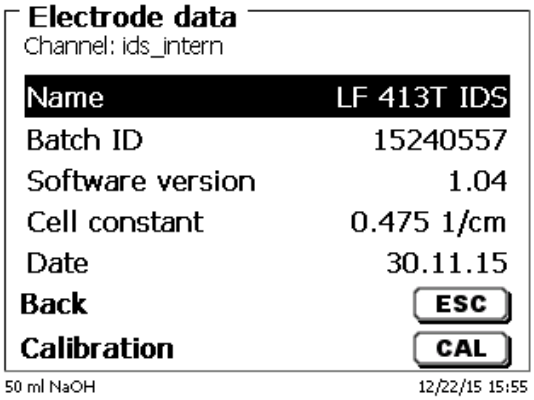

Fig. 215

5.4 RS232 Settings

The <**RS232 settings**> item can be used to determine the device address of the TitroLine® 7800 and set the parameters of the two RS232 interfaces independent from each other.

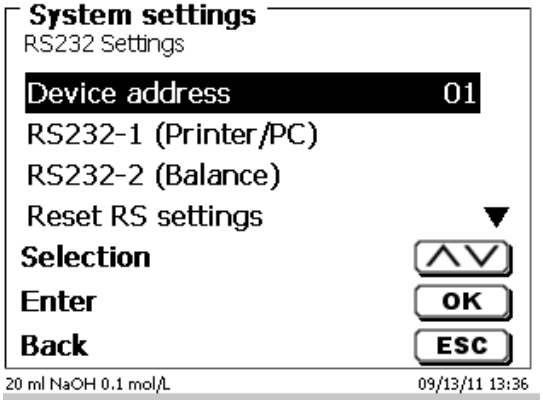

Fig. 216

The device address can be set from 0 - 15.
Address 1 is the default setting:

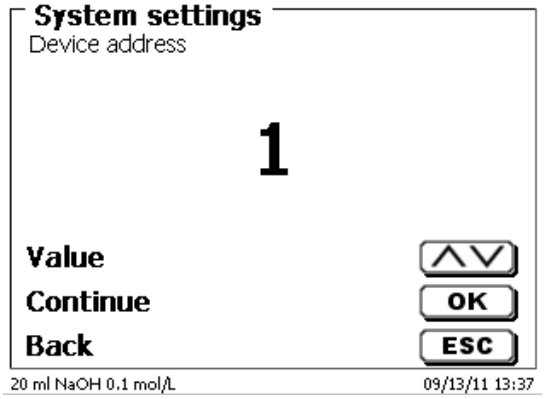

Fig. 217

The baud rate is preset to 4800.
It may be set to 1200 - 19200.

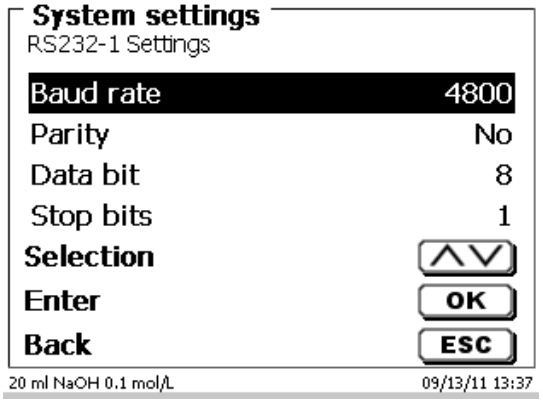

Fig. 218

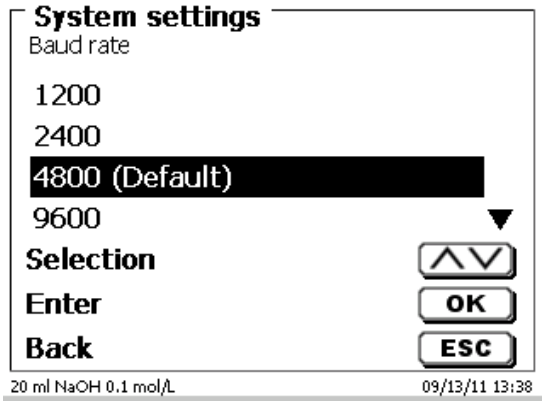

Fig. 219

The parity can be selected amongst <**No**>, <**Even**> and <**Odd**>.
<**No**> is the default setting.

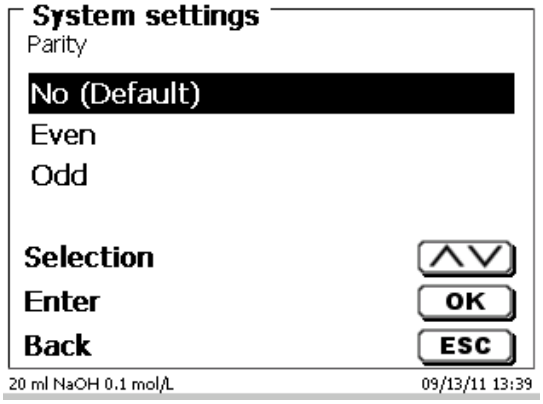

Fig. 220

You may select between 7 and 8 data bits. 8 bits is the default setting.

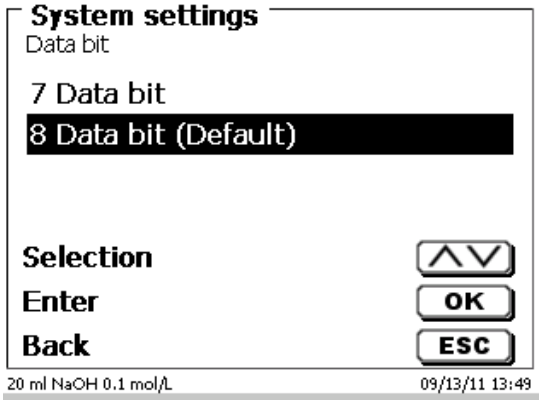

Fig. 221

The RS232 parameters can be set to the factory settings.

The RS232-1 can be converted from RS on USB
In this case, the titrator via the USB PC connection to the PC is connected.

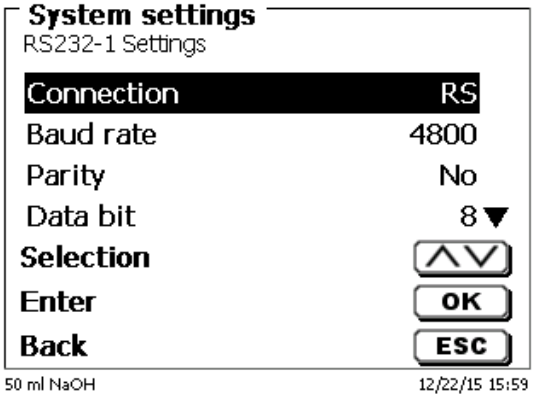

Fig. 222

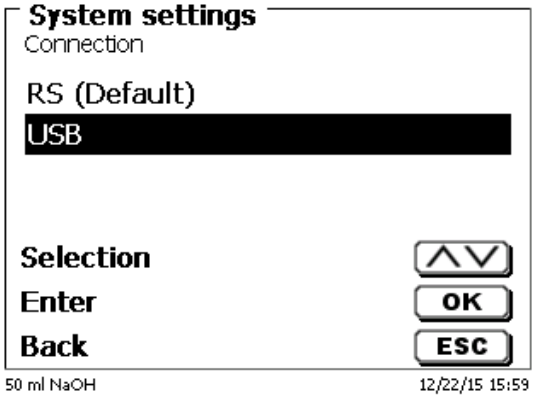

Fig. 223

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

The driver can be downloaded from thee SI Analytics website:
http://www.si-analytics.com/en/downloads/software-updates/titration.html

5.5 Date and Time

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

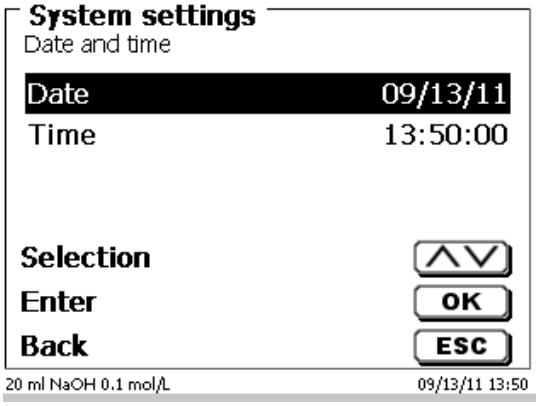

Fig. 224

5.6 Password

The activation of the password has not yet been implemented for the current version 15_50.
Please contact the service for sending you an update version.

5.7 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.

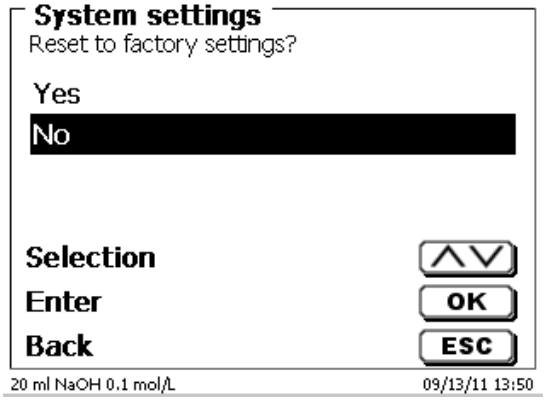

Fig. 225

5.8 Printer

For connecting printers please refer to 🕮 **Chapter 7.3**.

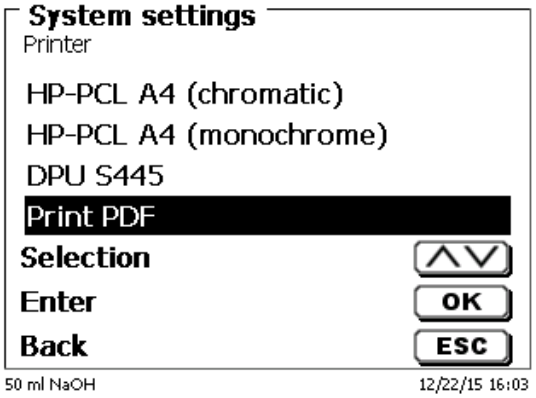

Fig. 226

5.9 Device Information

<Device Information> contains information about

- the current software version
- the serial number of the device
- printer driver version
- update version
- Export version
- device address

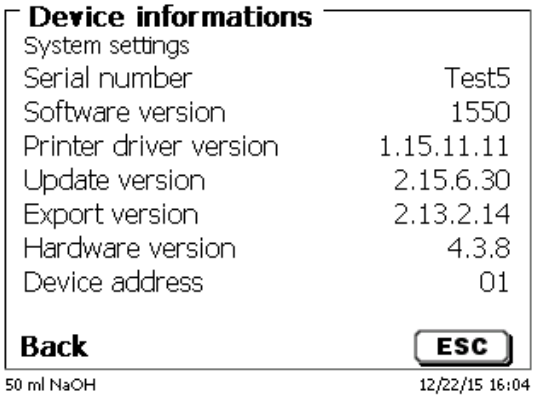

Fig. 227

5.10 System Tone

This is the point to set the volume of the system sounds and the front keyboard of the device.
The system sounds become audible e.g. at the end of the titration or in case of an erroneous operation.
The keys of the front keyboard produce a clicking sound if the key was used successfully.

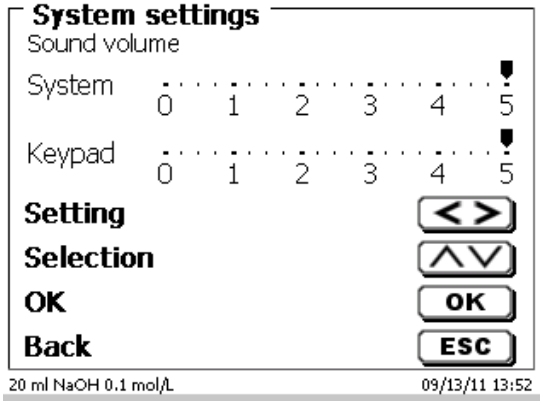

Fig. 228

No sounds will occur when the external keyboard is used.

5.11 Software Update

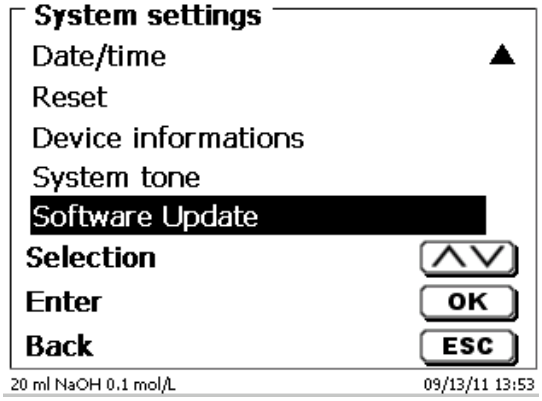

Fig. 229

An update of the device software 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.

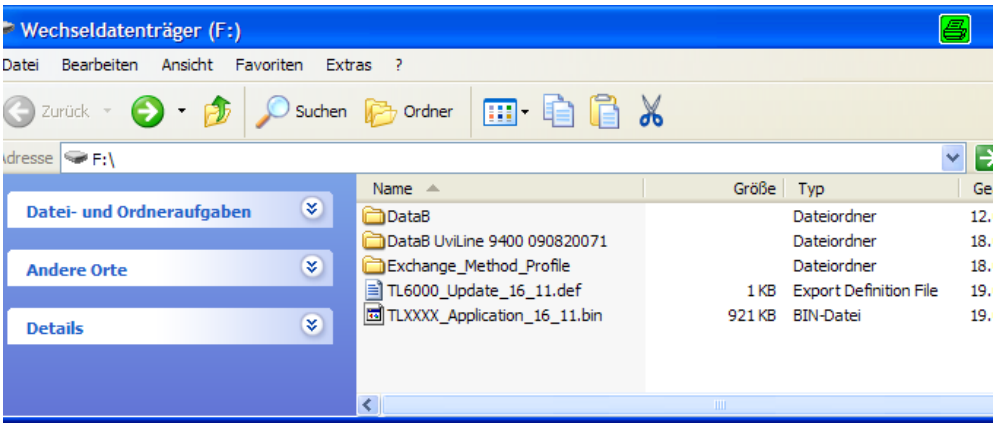

Fig. 230

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 this is Version “15_50“ from week 50 and year 2015.

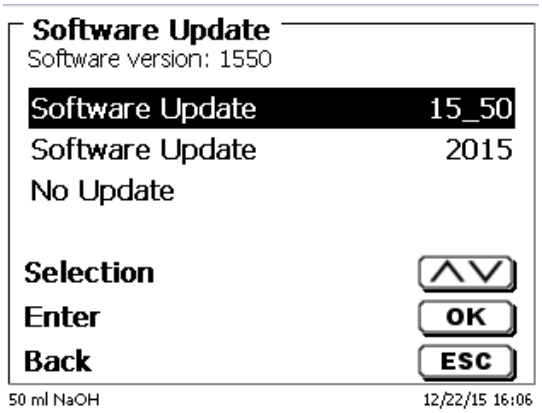

Fig. 231

After starting the update using <**OK/ENTER**>, next thing to appear is the following graphic

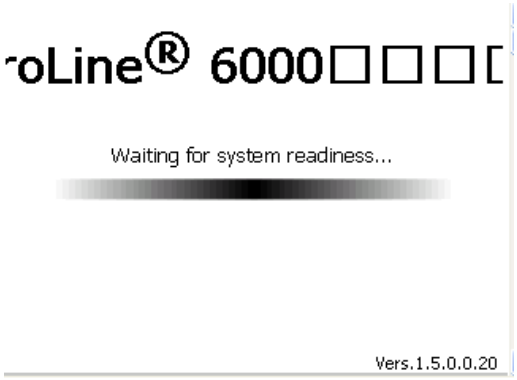

Fig. 232

which will change after a few seconds to the following display

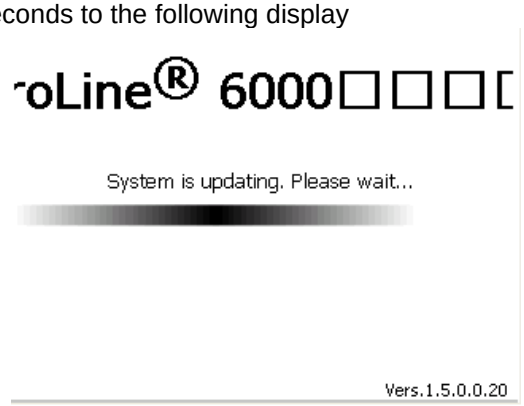

Fig. 233

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, the following message will appear

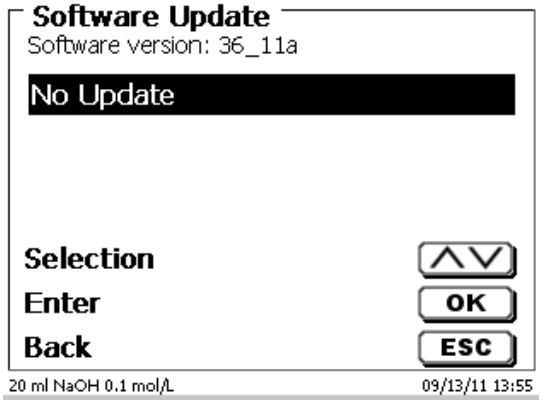

Fig. 234

6 Communication via RS-232 and USB-B interface

6.1 General Information

The TitroLine® 7800 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® 7800 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® 7800 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 🕮 **Chapter 5.3**.

The TitroLine® 7800 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® 7800 did before.

All information (data strings) which arrive at interface 2 of the TitroLine® 7800 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® 7800 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“	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
aaGDM	dosing speed in ml/min	aaY
aaGF	filling time in seconds (min is 20, default 30)	aaY
aaES	“ESC“ function one step backwards	aaY
aaEX	“exit“ function.back to main menu	aay
aafd	µa “dead stop“ measurement function	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	
aaLO	output documentation (as configured)	
aaRH	request of identification	aaIdent:TL500
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
aaSYS5	adjust language to “German“	aaY
aaSYS1	adjust language to “English“	aaY
aaSYS2	adjust language to “French”	aaY
aaSYS3	adjust language to “Spanish”	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® 7800. To connect the balance to the TitroLine® 7800, 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), partially Kern	TZ 3092
Mettler, AB-S, AG, PG	TZ 3099
Precisa XT-Serie	TZ 3183
Kern with 9-pole RS232	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® 7800.
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® 7800, 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® 7800 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® 7800, 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:

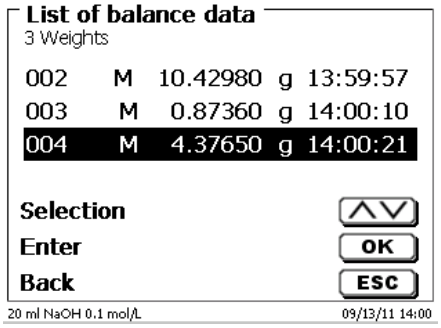

Fig. 235

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

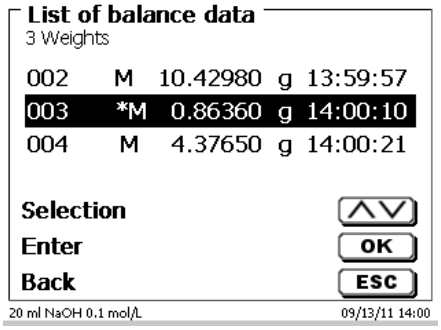

Fig. 236

Weights may be deleted or added individually. It is also possible to delete all weights at one stroke:

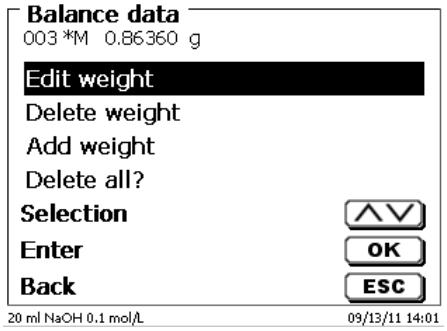

Fig. 237

If no balance data is available, the “No balance data found” message will appear:

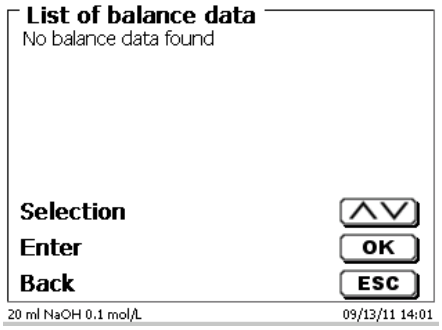

Fig. 238

7.3 Connection of 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.

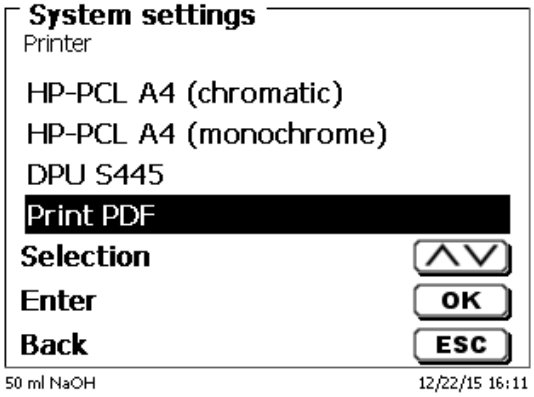

Fig. 239

Only one printer should be connected for one Titrator because an automatic printer recognition is not activated. “Print PDF” is the default setting

7.4 Connection of Autosampler

7.4.1 Connection of sampler changer TW alpha plus

The sample changer TW alpha plus is connected to the RS232-2 (RS2) of the titrator with cable **TZ 3087**.

The settings of the RS232-2 interface **must** be changed to 4800, No, 7, 2

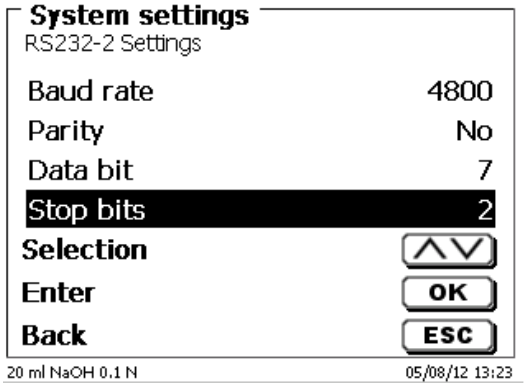

Fig. 240

The settings of the RS232-1 (4800, No. 8, 1) remain unaffected.

7.4.2 Connection of sample changer TW 7400

The sample changer TW 7400 plus is connected to RS232-2 (RS2) of the titrator by cable **TZ 3987**.

The settings of the RS232-2 interface do not have to be changed.
They can remain at 4800, No. 8,1.

7.5 Using software TitriSoft

7.5.1 General

The titrator is connected to the PC via the RS232 or USB-1-B interface.
Cables TZ 3097 and TZ 3091 can be used via RS232-1 for the connection.

7.5.2 TitriSoft 3.15 or higher

When using the new software 3.15 or higher TitriSoft, the factory settings of the RS232-1 can be maintained.

Reading and writing the intelligent exchange units and ID electrodes is possible with TitriSoft 3.15.
For more information, please refer to the user instructions of TitriSoft 3.15.

8 Maintenance and Care of the Titrator TitroLine® 7800

⚠ The preservation of the proper functioning of the TitroLine® 7800 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, i.e. zthey are or wearing parts, respectively. 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. crystallisation. 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® 7800 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® 7800 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. 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® 7800			
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 RTTE EG Richtlinie 2014/53/EU	EMC EC-Directive 2014/30/EU Safety EC-Directive 2014/35/EU RTTE EC-Directive 2014/53/EU	CEM CE-Directive 2014/30/EU Sécurité CE-Directive 2014/35/EU RTTE CE-Directive 2014/53/EU	CEM CEE siguientes 2014/30/EU Seguridad CEE siguientes 2014/35/EU RTTE CEE siguientes 2014/53/EU
Angewandte harmonisierte Normen oder normative Dokumente	Applied harmonized standards or normative documents	Normes harmonisées ou documents normatifs appliqués	Estándares armonizados aplicados o documentos normativos
EMV EN 61326-1:2013 Sicherheit EN 61010-1 :2010 RTTE EN 300 330-2 V1.5.1	EMC EN 61326-1:2013 Safety EN 61010-1 :2010 RTTE EN 300 330-2 V1.5.1	CEM EN 61326-1:2013 Sécurité EN 61010-1 :2010 RTTE EN 300 330-2 V1.5.1	CEM EN 61326-1:2013 Seguridad EN 61010-1 :2010 RTTE EN 300 330-2 V1.5.1

Mainz den 07.07.2016

Dr. Robert Reining
Geschäftsführer, Managing Director

Konf. No.: Titrat 022a

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Typ / type / type / tipo **TitroLine® 7800**

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.

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