



# Titration

TITRATORS, SAMPLE CHANGERS, SOFTWARE AND ELECTRODES

SI Analytics

a xylem brand

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# 1. The world of titration

## Our titrators

TitroLine® 5000, 7000, 7750, 7500 KF, 7500 KF trace, 7800 and the TITRONIC® 300 and 500 piston burettes with innovative features for simple and easy operation.

- ▶ High visibility, full color display that can be easily viewed from a distance and at extreme angles.
- ▶ Reagent data is securely stored in the intelligent and interchangeable modules (not: TITRONIC® 300 and TitroLine® 5000).
- ▶ Automatic wireless recognition of SI Analytics ID electrodes and IDS interface (TitroLine® 7800) guarantee accurate calibration and measurements
- ▶ Includes up to three USB, one LAN and two RS232 ports for expansion and connection of devices such as USB storage of methods and data, stirrer, laboratory balance, PC and more peripheral devices.
- ▶ Export the results as PDF or CSV, also to networks.
- ▶ Transfer of methods via USB device.

Advantages  
TitroLine®/TITRONIC®



TITRONIC® 500  
TitroLine® 7000 / 7750 / 7800



TitroLine® 5000  
TITRONIC® 300



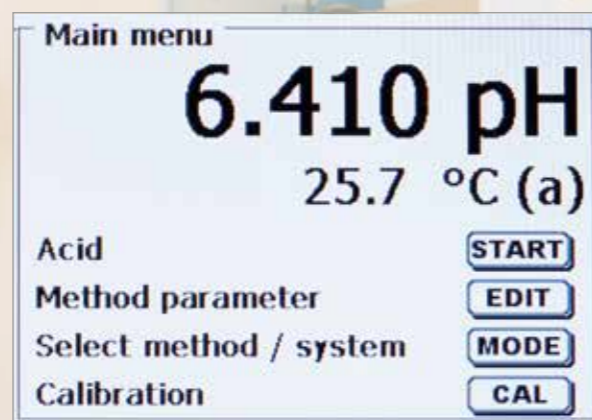
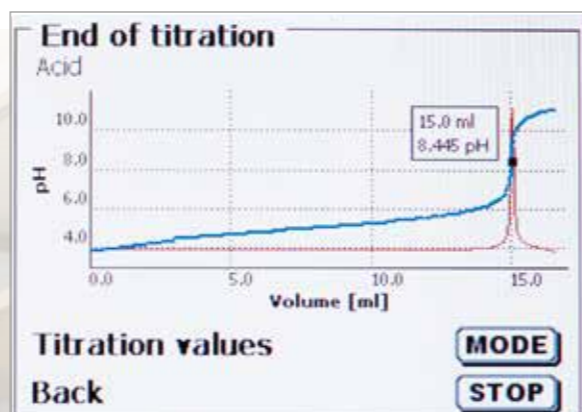
TitroLine® 7500 KF  
TitroLine® 7500 KF trace



# Loaded with features

## High visibility graphic display

- ▶ Exceptional high visibility graphic display for viewing even at extreme angles.
- ▶ Clear graphic representation of titration curves and the first derivative curve (TitrLine®).
- ▶ Equivalence point values are displayed in the titration curve (TitrLine®).



## Intelligent, interchangeable modules (except: T300/TL5000/TL7500 KF trace)

- ▶ Size options of 5, 10, 20 and 50 ml.
- ▶ Compact, space saving footprint.
- ▶ All relevant reagent and unit data are stored in the integrated RFID-chip including:
  - Burette size (ml)
  - Titrant name
  - Titrant concentration or titer value of solution
  - Date of manufacture or expiration date of the reagent.



Titrators/Burettes

## Flexible configuration features

Expand and customize your workstation using up to three USB, one LAN and two RS232 ports for a total of five connection options for:

- Magnetic stirrer TM 235 and USB mouse
- USB printer (Standard A4 HP-PCL) and compact printer TZ3863
- USB keyboard
- Network
- Barcode reader
- USB storage device and hub
- Balance and PC
- other SI Analytics devices

USB printer A4 format



Thermo printer DPU S445



USB manual controller

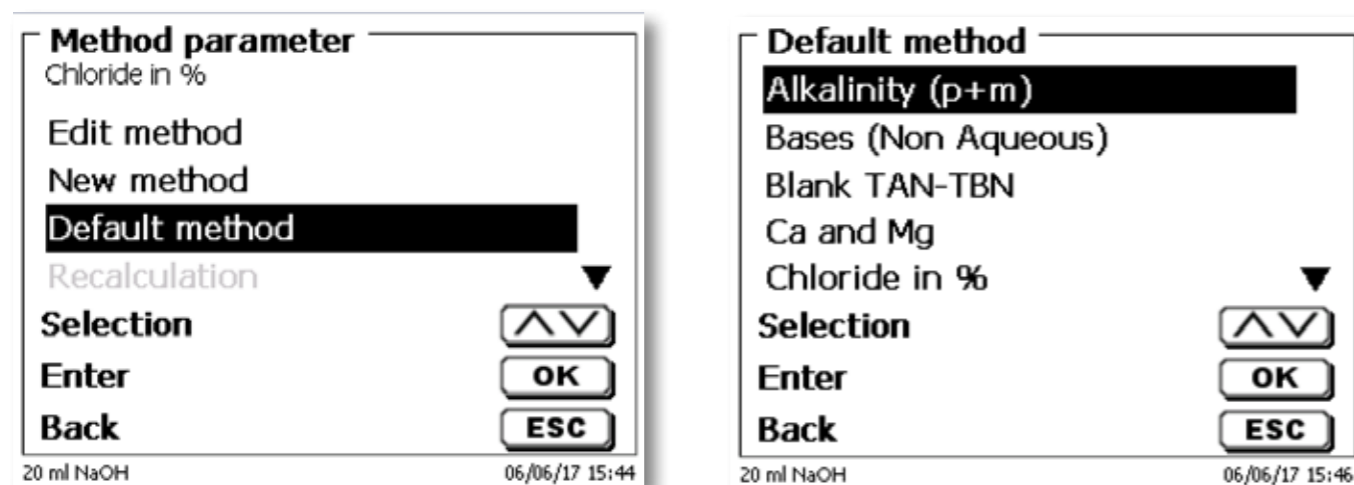


Keyboard

# Loaded with innovative features

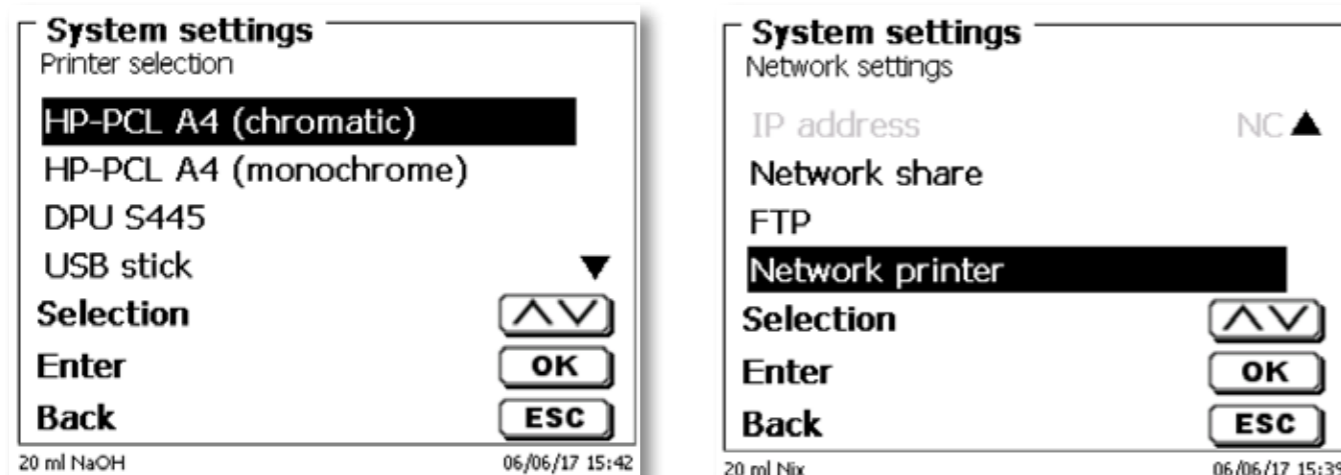
## Standard methods:

- Each piston burette or titrator has already pre-installed standard methods
- The standard methods are loaded and can be used, but also modified.
- The preinstalled standard method will always stay retained and can be re-installed at any time.



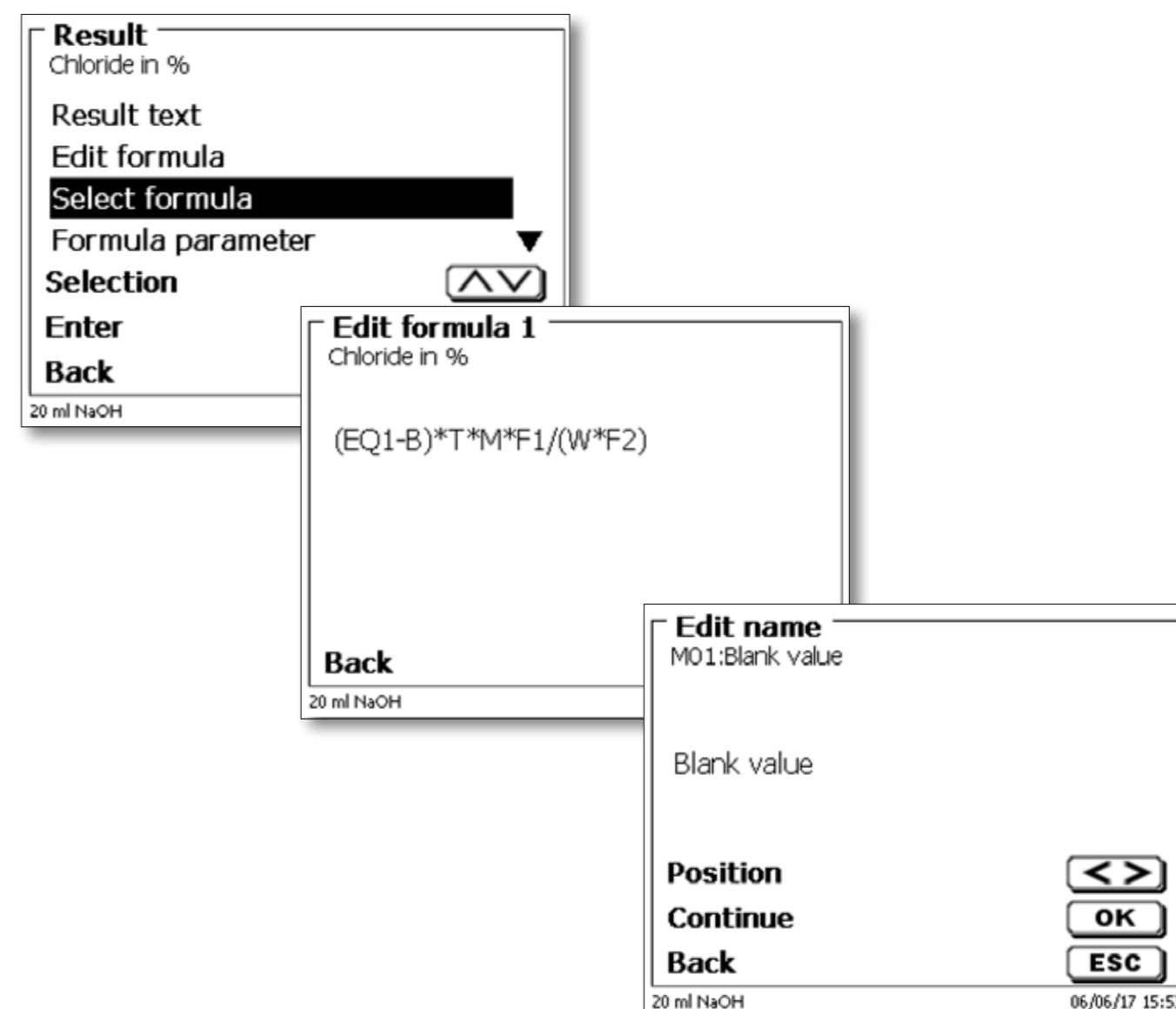
## Documentation:

- The results are documented on a USB device in PDF and CSV format.
- The results can also be printed on a DIN A 4 (color or b / w) or on a thermal printer.
- The printer can be connected directly to the titrator / piston burette, or it can be printed via a network printer.
- When connected to a network, the PDF and CSV files can be stored in a shared directory.



## Formula editor

- The Formula editor allows the use of individual calculations.
- Select one of the standard formulas and modify them if necessary.
- In addition to a number of units (%,, g / l ...) you can also assign an individual unit.
- Results (titre, blank value, etc.) can be automatically written to global memory and reused later.



# 1.1 Selection table titration -

## The most important features of titrators TitroLine®

# TITRONIC® and TitroLine®

## and piston burettes TITRONIC® at a glance

Application	TITRONIC® 300	TITRONIC® 500	TitroLine® 5000	TitroLine® 7000	TitroLine® 7500 KF	TitroLine® 7500 KF trace	TitroLine® 7750	TitroLine® 7800
Intelligent interchangeable units (5, 10, 20 and 50 ml)	1)	■	1)	■	■	—	■	■
Manual titration	■	■	■	■	—	—	■	■
Dosing	■	■	■	■	■	—	■	■
Solutions preparation (manually or automatically with connected balance)	—	■	—	■	■	—	■	■
Automatic titration (independent with external software)	2)	2)	■	■	■	■	■	■
Applications with TitrSoft	■	■	—	■	■	■	■	■
pH-stat-applications (enzyme kinetics, soil samples, biotechnology)	—	—	—	■	—	—	■	■
Applications with sample changer	—	—	—	■	—	—	■	■
pH/mV titrations „aqueous“ (Alkalinity, hydrochloric acid, citric acid, Kjeldahl...)	—	—	■	■	—	—	■	■
pH/mV titrations „non aqueous“ (TAN/TBN, FFA, titrations with perchloric acid...)	—	—	—	■	—	—	■	■
Redox titrations (iodometry, permanganometry...)	—	—	■	■	—	—	■	■
Redox titrations (COD)	—	—	■	■	—	—	■	■
Halide titrations (chloride, "salt"...)	—	—	■	■	—	—	■	■
Hydrogen sulphide and mercaptans	—	—	—	■	—	—	■	■
Sulfurous acid in wine and beverages	—	—	—	■	■	—	■	■
Bromine number	—	—	—	■	■	■	■	■
Water analysis according to KF Volumetric method (10 ppm - 100%)	—	—	—	—	■	—	■	■
Water analysis according to KF Coulometric method (1 ppm - 5%)	—	—	—	—	—	■	—	—
Measuring two parameters at the same time (e.g. pH and Cond)	—	—	—	—	—	—	—	■
Photometric titration (OptiLine 6)	—	—	—	■	—	—	■	■

1) 20 and 50 ml dosing unit usable (no intelligent interchangeable units)  
2) Can be used as titration and dosing burette in automatic titration systems

Titrators/Burettes

## 2. Applications Overview (examples)



### Water and Wastewater Analysis

Application	TitroLine® 5000	TitroLine® 7000 / 7750	TitroLine® 7800
Alkalinity (p+m-value)	■	■	■
COD	■	■	■
Permanganate index	■	■	■
FOS/TAC	■	■	■
pH + Cond + acid capacity	■	■	■
Kjeldahl-nitrogen/ammonia (after distillation)	■	■	■
Chloride in drinking and wastewater	■	■	■
Chlorine in drinking water	■	■	■
Calcium and magnesium hardness (2 equivalence points)	■	■	■
Total hardness (Sum Ca/Mg; 1 equivalence point)	■	■	■



### Food

Application	TitroLine® 5000	TitroLine® 7000 / 7750	TitroLine® 7800
Total acidity in wine and soft drinks	■	■	■
Total acidity in food (ketchup, salad dressing)	■	■	■
Ash alkalinity	■	■	■
Chloride ("salt") in food and mineral water	■	■	■
Sulfurous acid (SO <sub>2</sub> ), free and total	■	■	■
Volatile acids	■	■	■
Titrateable acidity in milk (Soxlet Henkel (SH) index)	■	■	■
Reducing sugars	■	■	■
Ascorbic acid (vitamin C)	■	■	■
Calcium in milk and dairy products	■	■	■
Calcium and magnesium in mineral water	■	■	■
Formol index	■	■	■
Nitrite in pickling salt	■	■	■
Iodine number	■	■	■
Peroxide number	■	■	■
Saponification number	■	■	■
Acidity (FFA) in fats and oils	■	■	■



### Industrial Products

Application	TitroLine® 5000	TitroLine® 7000 / 7750	TitroLine® 7800
Titration with perchloric acid (waterfree)	■	■	■
Hydroxyl number	■	■	■
NCO (Isocyanate) number	■	■	■
Epoxy number	■	■	■
Acid number in resins and other industrial products	■	■	■
Total acidity in mineral oils ("TAN")	■	■	■
Total base number ("TBN") in oils	■	■	■
Electroplating (Metals, acids, leach, etc.)	■	■	■

- Excellent application suitability
- Titration is possible for this application with restrictions and must be evaluated
- Not applicable



## 4.2 TitroLine® 7000: The professional step

With its performance spectrum, the TitroLine® 7000 is the ideal starting device for potentiometric titration with potential for expansion and automation. Thanks to the high-resolution and precise pH/ mV and "dead-stop" measuring interface, it is possible to determine a wide range of parameters quickly, reliably and accurate.

Besides the specifications of the instrument series from the general part already mentioned in the introduction and the features of the TITRONIC® 500 and TitroLine® 5000, the TitroLine® 7000 provides more:

### More methods

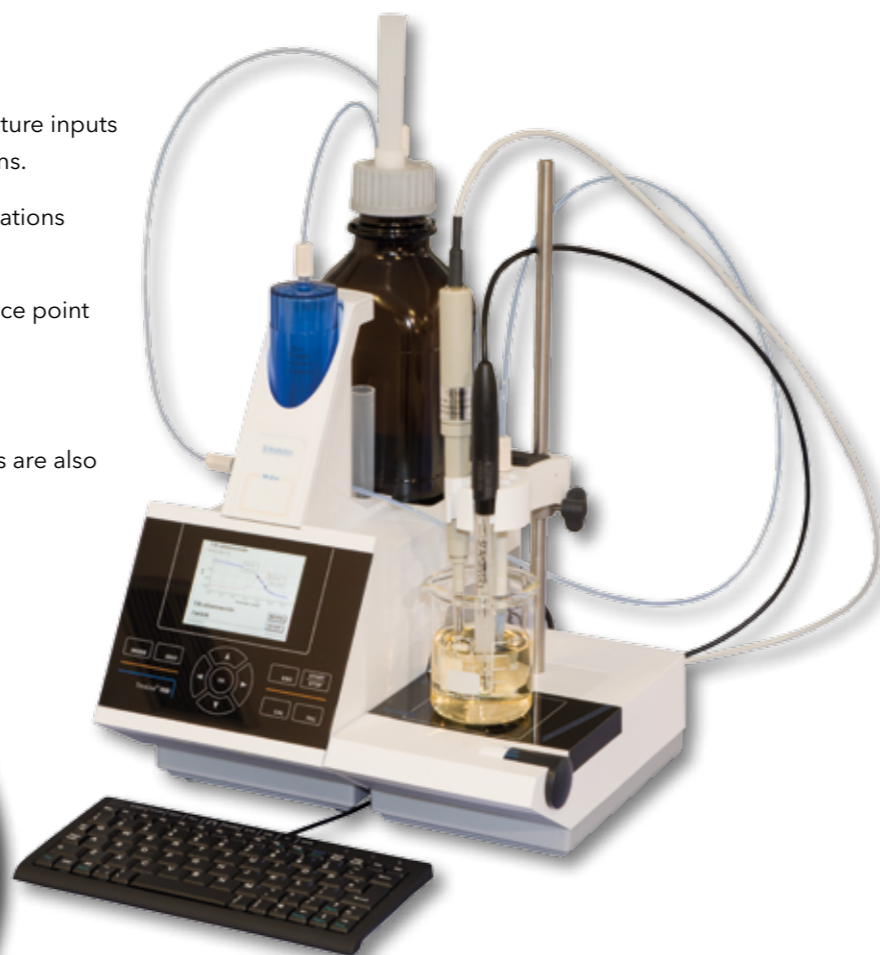
As a rule 10-15 user methods are usually enough for the most requirements. But sometimes you need a little bit more capacity. The TitroLine® 7000 offers storages up to 50 user methods.

### Measurement and calibration with the highest accuracy

...The wireless sensor recognition automatically recognizes SI Analytics® ID electrodes and instantly stores dedicated sensor data eliminating measurement and calibration errors.

### Features of the TitroLine® 7000 include

- High resolution pH/mV-electrode and temperature inputs for pH, ISE, redox (ORP) or photometric titrations.
- Polarizable electrode input for set endpoint titrations („Dead-stop“)
- Linear (fixed increment) and dynamic equivalence point titration mode
- Titrationen to pH/ mV and  $\mu$ A-Endpoint
- Manual titration mode and routine dosing tasks are also available.



pH/mV interface for ID electrodes

### Typical applications of the water/wastewater and environmental analysis:

- pH-value, alkalinity ("p+m-value")
- Permanganate index
- COD
- Volatile fatty acids/Total anorganic carbon (FOS/ TAC)
- Total nitrogen according to Kjeldahl
- Chloride in waste and drinking water
- Free and total chlorine in drinking and bathing water
- Ca/Mg-and total hardness
- Oxygen according to „Winkler“ method



Titration/Burettes

Titration application „chemical oxygen demand“ COD

### Application example for food analysis: "Determination of free and total sulphurous acid (SO<sub>2</sub>) in wine"

Since ancient times the wine is being preserved through the addition of "sulfur" (sulphurous acid).

The addition of sulphurous acid inhibits the oxidation processes and prevents the growth of unwanted micro-organisms. The content of free and total sulphur (exact: sulphur dioxide) is determined through the titration of 10-50 ml sample after the addition of sulphuric acid and potassium iodide with a iodine solution (e.g. 0.025 mol/l) and using a double platinum electrode as indication electrode. The free SO<sub>2</sub> is titrated directly. The total SO<sub>2</sub> is titrated after the hydrolysis with sodium hydroxide which converts the bounded SO<sub>2</sub> into the free form. The method with all parameters and calculation formula is already stored as standard method in the TitroLine® 7000 and can be used directly

### Typical applications of food analysis:

- Salt content (chloride, sodium chloride).
- pH-value, total acidity in wine, beverages and food products such as condiments.
- Formol number in fruit and vegetable juices.
- Ascorbic acid (Vitamin C).
- Calcium in milk and dairy products.
- Protein determination (Kjeldahl-nitrogen) in milk and dairy products.
- Reducing sugar in wine and juices.
- Iodine number, peroxide number, free fatty acids and saponification number.
- Determination of free and total sulphurous acid (H<sub>2</sub>SO<sub>3</sub>) in wine and must. Further detail is available in the application example.



# TitroLine® 7000 - Versatile Applications

## Perfect for non-aqueous titrations

Eliminate the need for special electrodes (e.g. separate indicator, reference and auxiliary electrodes) with the built-in amplifier-perfect for titrations in non-aqueous solvents such as:

- Acid and base numbers in oils (TAN and TBN)
- Titrations in glacial acetic acid with perchloric acid
- Hydroxyl, NCO (Isocyanate) number and further specific value

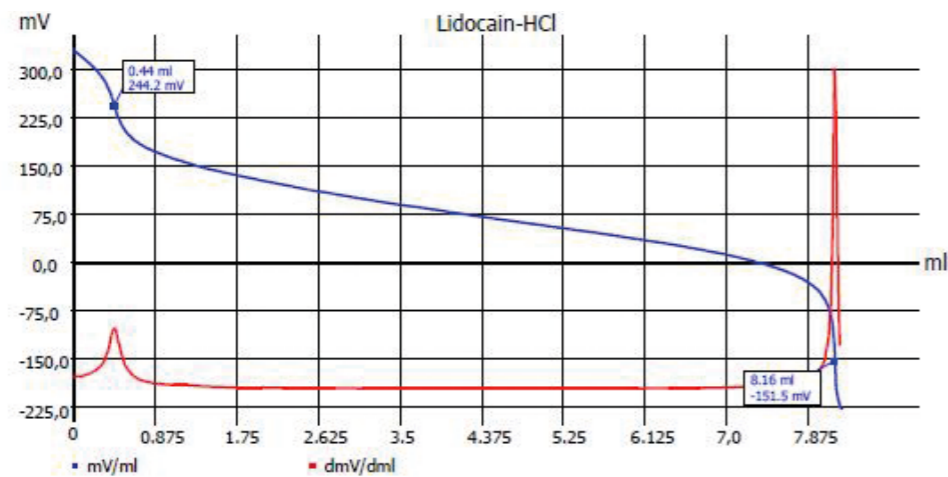
## pH-Stat Titration

With a pH stat application a given pH is first adjusted and then kept constant at the certain time with an acid or a base. The pH stat titration is applied to e.g.:

- the determination of the enzyme activity (ex. lipase)
- the pH stat elution of soil sample at pH 4
- the monitoring of the pH value during chemical syntheses

### Typical Pharma application example: Titration of amino hydrochlorides (method according Ph. EUR).

Up to now the amino hydrochlorides were dissolved in glacial acetic acid, the amines released through the addition of mercuric acetate and titrated with perchloric acid in glacial acetic acid. According to the environment friendly method of the European Pharmacopeia the amino hydrochlorides are dissolved in ethanol and being dosed with exact 5.00 ml of a 0.01 mol/l HCl. This mixture is then titrated with NaOH 0.1 mol/l. Most titration curves show two equivalence points. The result is calculated from the difference between the first and second equivalence point. The method with all parameters and calculation formulae is already stored as standard method in the TitroLine® 7000 and can be used directly after the input of the equivalent substance weight.



Titration curve: Titration of Hydro chloride (Lidocain-HCl)

## Titration with the new photometric sensor OptiLine 6

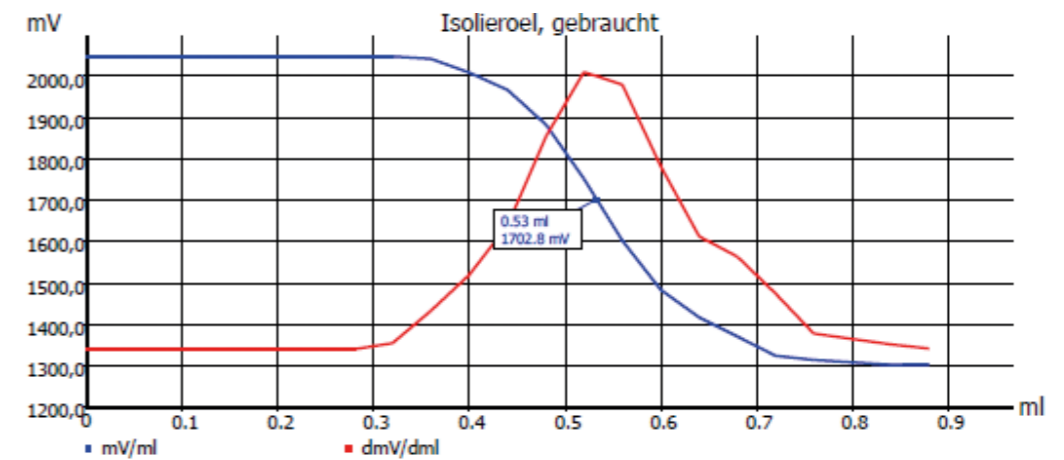
The TitroLine® 7000 allows the connection of the new OptiLine 6 (please see also page 84) photometric sensor via USB. The TitroLine® 7000 uses the digital USB input to set the wavelength and other parameters of the photometric sensor.



TitroLine® 7800 with OptiLine 6

With the OptiLine 6, for example, the following applications are possible:

- All complexometric titrations of metals such as calcium, magnesium (total hardness), zinc, copper etc.
- All titrations with color indicator, which are prescribed in the Ph.Eur, USP, and further pharmacopeials. These titrations can now be performed automatically.
- Turbidity titration of Chondroitin sulphate according to Ph.Eur and USP
- Titration of Total acid - or Basen number (TAN and TBN) using the color indicator method.
- Determination of carboxyl end groups in polyethylene terephthalate (PET)
- For further applications examples please see page 85.



Titration curve: TAN acc. to ASTM D974