





8.101.8003EN



Metrohm AG CH-9101 Herisau Switzerland Phone +41 71 353 85 85 Fax +41 71 353 89 01 info@metrohm.com www.metrohm.com





8.101.8003EN

01.2009 jb/ek

Teachware Metrohm AG CH-9101 Herisau teachware@metrohm.com

This documentation is protected by copyright. All rights reserved.

Although all the information given in this documentation has been checked with great care, errors cannot be entirely excluded. Should you notice any mistakes please send us your comments using the address given above.

# **Table of contents**

1	Introdu	uction	1
	1.1	Structure of the tutorial	1
	1.2	Program structure	2
	1.3	Symbols and conventions	3
2	Titratio	on without automation	4
	2.1	Configuration	4
	2.1.1	Connecting a Titrando including a stirrer	4
	2.1.2	Connecting a Titrino	5
	2.1.3	Adding and configuring a titrant	
	2.1.4	Configuring a pH electrode	13
	2.2	Creating a titration method	15
	2.3	Carrying out a titration	27
	2.3.1	Preparing the exchange or dosing unit	27
	2.3.2	Carrying out a titration	29
	2.4	Database	33
	2.4.1	Overview	33
	2.4.2	Adapting the layout	
	2.4.3	Reprocessing a determination	
	2.4.4	Printing out a report	
3	Titratio	on with automation	40
	3.1	Configuration	40
	3.1.1	Connecting a USB Sample Processor	40
	3.1.2	Connecting a balance	41
	3.1.3	Assigning lift positions	
	3.1.4	Defining special beakers	
	3.2	Creating an automation method	51
	3.2.1	Loading the method	
	3.2.2	Extending the titration method	52

3.3	Performing a sample series61
3.3.1	Creating a sample table61
3.3.2	Performing a sample series65
3.3.3	Displaying statistics results
3.4	Extending the automation method69

# **1** Introduction

# **1.1 Structure of the tutorial**

The present tutorial guides you through your first steps with the software  $tiamo^{TM}$ . You will be introduced to the most important operating features by using a simple pH titration as an example.

The tutorial is structured in two parts:

#### Part 1: Titration without automation

- Configuration
  - Connecting a Titrando or a Titrino
  - Adding a titrant
  - Connecting a pH electrode
- Method
  - Creating a method using a template
  - Carrying out a titration
- Database
  - Results view in the determination database
  - Reprocessing a determination
  - Printing a report

#### Part 2: Titration with automation

- Adding a USB Sample Processor to an existing titration system and configuring it
- Modifying the titration method used in Part 1 in a few steps
- Creating a sample table in order to carry out a sample series

# **1.2 Program structure**

*tiamo*<sup>™</sup> comprises the following program parts:

#### Workplace



#### Database



Method



#### Configuration



#### Manual



Open/Close workplaces

- Start single determinations and determination series
- Create sample tables
- Open/Close databases
- Manage databases
- Reprocess determinations
- Create method templates
- Create new methods
- Open/Close existing methods
- Manage methods
- Configure devices, solutions, sensors, common variables and rack data
- Security settings
- User administration
- Audit Trail
- Dosing
- Preparing exchange/dosing unit
- Measuring
- Stirring
- Automation functions

Detailed information on *tiamo*<sup>™</sup> can be found in the online help. **[F1]** opens the help for the corresponding dialog.

# **1.3 Symbols and conventions**

The following symbols and styles are used in this documentation:

1	Instruction step
	Carry out these steps in the sequence shown.
Method	Dialog text, parameter in the software
File ► New	Menu or menu item
[Next]	Button or key
i	<b>Note</b> This symbol marks additional information and tips.

# **2** Titration without automation

The following instruments are required for the titration described:

- Titrando or Titrino
- Exchange unit or Dosino with dosing unit
- Stirrer

# 2.1 Configuration

#### 2.1.1 Connecting a Titrando including a stirrer

Proceed as follows to connect a Titrando:

#### 1 Connect the devices

- Connect a stirrer and if available an external dosing device to an MSB connector of the Titrando.
- Connect the controller connector of the Titrando with a USB connector on the computer.
  - Use 6.2151.000 cable.
- Connect the Titrando to the mains supply.

#### 2 Software settings

Start tiamo.

The Titrando is recognized automatically:



Confirm the message with **[Yes]**.
 The properties dialog of the Titrando is opened.

	he	propert	ies dia	log o	t the	litrand	o is	oper	ied:
--	----	---------	---------	-------	-------	---------	------	------	------

Properties - 836 Titrando	o - 836_1	×
General GLP		
Device name	836_1	
Device type	836 Titrando	
Program version	5.836.0022	
Device serial number	02180	
Set to work	2008-12-22 15:57:38 UTC+1	
Remarks		
	ОК	Cancel

 Under **Device name**, enter a designation that describes the Titrando unambiguously and confirm with **[OK]**.

The Titrando is added to the list of devices.

# 2.1.2 Connecting a Titrino

1 Note
Titrinos are not recognized automatically and must be added manually to the list of devices.

To connect a Titrino a RS-232 cable is needed:

- 6.2125.110 (25-pin 9-pin) for Titrinos with 25-pin RS-232 interface
- 6.2134.040 (9-pin 9-pin) for Titrinos with 9-pin RS-232 interface

Proceed as follows to connect a Titrino:

#### 1 Connect the devices

- Connect the Titrino to the RS-232 interface COM1, COM2, ... of the computer.
- Connect the Titrino to the mains supply.
- Switch on the Titrino.



- Start tiamo.
- In the sidebar, click on the symbol [Configuration].

Device name A     Device type     Device serial n     Status     Status       1     356_1     835 Thrando     02180     ok     2008       Intrants/Solution name A     Concentration     Cylinder volume     Type       Intrants/Solution name A     Sensor name A     Sensor type     Set to work     Expiry date       Infigurator     Infigurator     Infigurator     Infigurator     Infigurator     Infigurator       Infigurator     Infigurator     Infigurator     Infigurator     Infigurator     Infigurator       Infigurator     Infigurator     Infigurator     Infigurator     Infigurator     Infigurator       Infigurator     Infigurator     Infigurator     Infigurator     <	iamo 2.0 ·	- Confi	iguration											_ 🗆
Device spin     Device type     Device serial n     Status     Status       1     636 Trando     02180     ok     2006       1     5     636 Trando     02180     ok       1     5     636 Trando     02180     ok       1     5     5     5     5       1     5     5     5     5       1     5     5     5     5       1     5     5     5     5       2     15     6     5     5       3     16     6     2006     12:22       10     5     7     5     5       10     5     1     5     1	View 1	Tools	Help											
Device name A     Device type     Device stril n     Status     So       1     356     356 Tirando     02180     ok     2006       atabase     0     0     0     2006     0       1     356.1     0.56 Tirando     02180     ok     2006       1     356 Tirando     02180     ok     2006       1     Sorsor name A     Sensor type     Set to work     Expiry date       1     Sensor type     Set to work     Expiry date       1     Contentration     Cylinder volume     Type       1     Contentration     Contentration     Cylinder volume       1     Contentration     Sensor type     Set to work     Expiry date       1     Contentration     Sensor type     Set to work     Expiry date       2     State     Sensor type     Sensor type     Sensor type       3     Hetal electrode     2006-12-22     10001       5     Temperature sen     2006-12-22 <th></th> <th>100 a</th> <th>🛏 🔊   🕵   🖁</th> <th>)</th> <th></th>		100 a	🛏 🔊   🕵   🖁	)										
Image: Series region     Image:				·					Titrants/S	lutions				
I I				Device type	Device s	erial n	Status				Concentration	Cylinder volume	Type	D
orkplake Rubbase Tethod Figuration Figuration Figuration Temperature sen Temperature sen 2008-12-22 Temperature sen Temperature sen 2008-12-22		▶ 1	836_1	836 Titrando			ok	2008						
Rubase Tethod Figuration Fi			, -											
Edt.     1     Edt.     1       Sensors     Common Variables       1     Conductivy sensor Conductivy sensor 2008-12-22       2     55 electrode     2008-12-22       4     pH electrode     2008-12-22       5     freeprature sen     2008-12-22       10     5     remperature sen	orkplace													
Edt.     Image: Sensor Sensor Sensor System       Sensors     Common Variables       1     Conductivy sensor Conductivy sensor 2008-12-22       2     SE electrode       9 Het electrode     PH electrode       1     Sensor														
Edt.     Image: Sensor Sensor Sensor System       Sensors     Common Variables       1     Conductivy sensor Conductivy sensor 2008-12-22       2     SE electrode       9 Het electrode     PH electrode       1     Sensor														
Edt     Image: Sensors       Sensors     Common Variables       Sensors     Common Variables       1     Conductivy sensor Conductivy sensor 2008-12-22       2     Selectrode       2     Selectrode       4     pH electrode       9     Het electrode														
Edt     Image: Sensors       Sensors     Common Variables       Sensors     Common Variables       1     Conductivy sensor Conductivy sensor 2008-12-22       2     Selectrode       2     Selectrode       4     pH electrode       9     Het electrode														
Edit     Image: Sensor Name A     Sensor	cabase													
Edt     Edt     Image: Comparison of the second sec	2													
Edit         Edit         Image: Common Variables           Sensor         Sensor type         Set to work         Expiry date           1         Conductivity sensor Conductivity sensor 2008-12-22         Participation         Name A         Type         Value         Unit           2         Setsor name A         Sensor type         Set to work         Expiry date         Name A         Type         Value         Unit           3         Netal electrode         pH electrode         2008-12-22         100         5         Temperature sen         Temperature sen         2009-12-22         100	<u> </u>													
Edit         I         Conductivity sensor 2008-12-22         Common Yariables           2         Sensor name A         Sensor type         Set to work         Expiry date           1         Conductivity sensor 2008-12-22         69.2           3         Metal electrode         pH electrode         2008-12-22           4         pH electrode         2008-12-22         100.           5         Temperature sen Temperature sen 2008-12-22         100.	<u> </u>													
Edit         Edit         Image: Common Variables           Sensor         Sensor type         Set to work         Expiry date           1         Conductivity sensor Conductivity sensor 2008-12-22         Participation         Name A         Type         Value         Unit           2         Setsor name A         Sensor type         Set to work         Expiry date         Name A         Type         Value         Unit           3         Netal electrode         pH electrode         2008-12-22         100         5         Temperature sen         Temperature sen         2009-12-22         100														
Iguration I  Sensor nome A Sensor types Setto work Explyr date I Name A Type Value Unit I I I Setor nome A Sensor types Value Unit I I I I I I I I I I I I I I I I I I I	ethod													
guration       Image: Service runge A       Image: Service runge A       Image: Service runge A       Image: Service runge A       Image: Service runge A       Image: Service runge A       Image: Service runge A       Image: Service runge A       Image: Service runge A       Image: Service runge A       Image: Service runge A       Image: Service runge A       Image: Service r														
Iguration I  Sensor nome A Sensor types Setto work Explyr date I Name A Type Value Unit I I I Setor nome A Sensor types Value Unit I I I I I I I I I I I I I I I I I I I		L	Edit 💌	•				►	Edit 🔻		•			
2       ISE electrode       TSE electrode       2008-12-22       -59.2         3       Metal electrode       2008-12-22       100.0         4       pH electrode       2008-12-22       100.0         5       Temperature sen       7008-12-22       100.0		-		•							•]			
3     Metal electrode     2008-12-22     100.       4     pH electrode     2008-12-22     100.       5     Temperature sen     Temperature sen     2008-12-22		-	sors			Expiry	date		Common V	ariables			Unit	A
4     pH electrode     pH electrode     2008-12-22     100.4       5     Temperature sen     Temperature sen     2008-12-22		Sens	Sensor name A	Sensor type	Set to work	Expiry	date		Common V	ariables			Unit	A
5 Temperature sen Temperature sen 2008-12-22		Sens	sors Sensor name ▲ Conductivity sensor	Sensor type Conductivity sensor	Set to work 2008-12-22	Expiry	date		Common V	ariables			Unit	A
		<b>Sens</b> ▶ 1 2	Sensor name A Conductivity sensor ISE electrode	Sensor type Conductivity sensor ISE electrode	Set to work 2008-12-22 2008-12-22	Expiry	date		Common V	ariables			Unit	A
		Sens ▶ 1 2 3	Sors Sensor name A Conductivity sensor ISE electrode Metal electrode	Sensor type Conductivity sensor ISE electrode Metal electrode	Set to work 2008-12-22 2008-12-22 2008-12-22	Expiry	date	-59.2	Common V	ariables			Unit	A
		Sens ▶ 1 2 3 4	Sors Sensor name A Conductivity sensor ISE electrode Metal electrode pH electrode	Sensor type Conductivity sensor ISE electrode Metal electrode pH electrode	Set to work 2008-12-22 2008-12-22 2008-12-22 2008-12-22	Expiry	date	-59.2	Common V	ariables			Unit	A
		Sens ▶ 1 2 3 4	Sors Sensor name A Conductivity sensor ISE electrode Metal electrode pH electrode	Sensor type Conductivity sensor ISE electrode Metal electrode pH electrode	Set to work 2008-12-22 2008-12-22 2008-12-22 2008-12-22	Expiry	date	-59.2	Common V	ariables			Unit	A
		Sens ▶ 1 2 3 4	Sors Sensor name A Conductivity sensor ISE electrode Metal electrode pH electrode	Sensor type Conductivity sensor ISE electrode Metal electrode pH electrode	Set to work 2008-12-22 2008-12-22 2008-12-22 2008-12-22	Expiry	date	-59.2	Common V	ariables			Unit	A
		Sens ▶ 1 2 3 4	Sors Sensor name A Conductivity sensor ISE electrode Metal electrode pH electrode	Sensor type Conductivity sensor ISE electrode Metal electrode pH electrode	Set to work 2008-12-22 2008-12-22 2008-12-22 2008-12-22	Expiry	date	-59.2	Common V	ariables			Unit	A
		Sens ▶ 1 2 3 4	Sors Sensor name A Conductivity sensor ISE electrode Metal electrode pH electrode	Sensor type Conductivity sensor ISE electrode Metal electrode pH electrode	Set to work 2008-12-22 2008-12-22 2008-12-22 2008-12-22	Expiry	date	-59.2	Common V	ariables			Unit	A
		Sens ▶ 1 2 3 4	Sors Sensor name A Conductivity sensor ISE electrode Metal electrode pH electrode	Sensor type Conductivity sensor ISE electrode Metal electrode pH electrode	Set to work 2008-12-22 2008-12-22 2008-12-22 2008-12-22	Expiry	date	-59.2	Common V	ariables			Unit	A
		Sens ▶ 1 2 3 4	Sors Sensor name A Conductivity sensor ISE electrode Metal electrode pH electrode	Sensor type Conductivity sensor ISE electrode Metal electrode pH electrode	Set to work 2008-12-22 2008-12-22 2008-12-22 2008-12-22	Expiry	date	-59.2	Common V	ariables			Unit	A
		Sens ▶ 1 2 3 4	Sors Sensor name A Conductivity sensor ISE electrode Metal electrode pH electrode	Sensor type Conductivity sensor ISE electrode Metal electrode pH electrode	Set to work 2008-12-22 2008-12-22 2008-12-22 2008-12-22	Expiry	date	-59.2	Common V	ariables			Unit	A
anual Edit V 4		Sens ▶ 1 2 3 4	Sors Sensor name A Conductivity sensor ISE electrode Metal electrode pH electrode	Sensor type Conductivity sensor ISE electrode Metal electrode pH electrode	Set to work 2008-12-22 2008-12-22 2008-12-22 2008-12-22	Expiry	· date	-59.2	Common V	ariables			Unit	A
anaa p		Sens ▶ 1 2 3 4 5	sors Sensor name A Conductivity sensor ISE electrode Metal electrode pH electrode Temperature sen	Sensor type Conductivity sensor ISE electrode Metal electrode pH electrode Temperature sen	Set to work 2008-12-22 2008-12-22 2008-12-22 2008-12-22 2008-12-22	Expiry	date	-59.2	Common ¥ Ne	nriables me A	Туре	Value	Unt	A

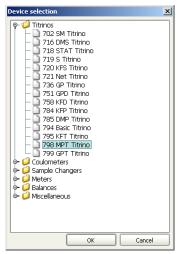
The program part **Configuration** has the following subwindows:

Devices	List of automatically recognized and manually added devices.
Titrants/Solutions	List of automatically recognized and manually added titrants and auxiliary solutions.
Sensors	List of all sensors defined.
<b>Common Variables</b>	List of all common variables defined.
Sample solutions (TC conductivity)	List of the solutions a temperature coefficient has been determined for.



#### 3 Add the device

- In the subwindow **Devices**, click on the menu item **Edit** ▶ **New...**.
- Double-click the item **Titrinos**.
   The list of the Titrinos available is displayed:



• Select the Titrino from the list and confirm with **[OK]**.

The properties dialog of the Titrino is opened:

#### 2.1 Configuration

operties -	798 MPT Tit	rino - 798_1			×
General	Int. Dosing	device D0	RS 232	GLP	 
	Device name	798_1			
	Device type	798 MPT Titrin	10		
Pri	ogram version				
Device	serial number				
	Set to work	2008-12-22 1	6:11:40 UTC	+1	
	Remarks				
				ок	ancel

# 4 Configure the device

- Under **Device name**, enter a designation that describes the Titrino unambiguously.
- Click on the tab **RS 232**.

Properties - 798 MPT Titrino - 798_1	×
General Int. Dosing device D0 R5 232	GLP
COM Port COM1	
Baud rate	
	Connect
	OK Cancel

• Select the RS-232 interface of the computer the Titrino is connected to.

• Confirm the entries with **[OK]**.

The Titrino is added to the the list of devices.

# 2.1.3 Adding and configuring a titrant

#### Titrant in an exchange or dosing unit with data chip



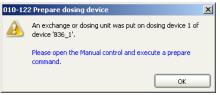
The following description only applies if a Titrando is used. For Titrinos: *see page 11*.

Proceed as follows to add a titrant to the list of titrants:

#### 1 Attach the exchange or dosing unit

• Attach the exchange unit to the Titrando or the Dosino to the dosing unit.

As soon as the exchange or dosing unit has been recognized the following message is displayed:



All tubings and cylinders are rinsed with the **Prepare** function. Preparing exchange or dosing units is described in *chapter 2.3.1, page 27*. The exchange or dosing unit must first be configured.

Confirm the message with [OK].
 The following message is displayed:



• Confirm the message with [OK].

trant/Solu	tion -		Į
Solution	Titer	Titer history Exchange unit GLP	
Soluti	on name		-
Conce	entration	1.000 mol/L	
c	Comment		_
Product	ion date		
Solutio	n monit	oring	
Wo	rking life	999 days	
Exp	oiry date		
Messag	je —		
	Message	by e-mail E-mail	
	Acoustic	signal	
Action			
0	Record m	nessage	
0	Display m	nessage	
0	Stop dete	remination	
		OK Cancel	

The properties dialog of the titrant is opened:

#### 2 Configure the titrant

- Enter a solution name or select an existing name from the list.
- Define the concentration of the titrant.
- Switch on the option **Solution monitoring**.
- As working life enter, for example, 60 days.

• Confirm the entries with **[OK]**.

The titrant is added to the list of titrants.

# Titrant in an exchange or dosing unit without data chip

A titrant in an exchange or dosing unit without data chip must be added manually to the list of titrants. The exchange or dosing unit does not need to be attached for this.



#### Note

If you use an exchange unit with data chip with a Titrino you will also have to manually add the titrant to the list of titrants.

Proceed as follows to add a titrant to the list of titrants:



#### 1 Open the program part "Configuration"

• In the sidebar, click on the symbol [Configuration].

Edit 🔻	
New +	Exchange Unit
Delete	Dosing Unit 🧏
Properties	
Column display	
Print (PDF)	

#### 2 Add a titrant

 In the subwindow Titrants/Solutions, click on the menu item Edit > New > Exchange or Dosing Unit....

The properties dialog of the titrant is opened:

#### 2.1 Configuration

Solution	Titer	Titer history	Exchange unit	GLP	
Solut	ion name				•
Conce	entration	1.000	mol/L	]	
(	Comment				
Produc	tion date				
Solutio	on monito	oring			
We	orking life	999 c	lays		
Ex	piry date		)		
Messa	ge				
	Message I	oy e-mail			E-mail
	Acoustic s	ignal			
Action					
0	Record me	essage			
0	Display me	essage			
0	Stop dete	rmination			

#### **3** Configure the titrant

- Enter a solution name or select an existing name from the list.
- Define the concentration of the titrant.
- Switch on the option **Solution monitoring**.
- As working life enter, for example, 60 days.

itrant/Solution -						
Solution Titer Ti	er history	Exchange	unit	GLP		
Hardware						_
Name						_
Туре	EU					
Order numbe						
Serial number						
Cylinder volume			20 💌 r	nL		
Cylinder serial numbe						
Parameters for prepar	ation					
Volume	c	ylinder volu	me 💌 r	nL		
Cycle			2 💌			
Dosing rate		maxim	um 💌 r	nL/min		
Filling rate		maxim	um 💌 r	nL/min		
Tubing parameters						
	Length		Diameter			
Dosing tip	40.0	cm [		2.0 mm		
Cylinder	13.0	] cm [		2.0 mm		
Reagent bottle	25.0	] cm [		2.0 mm		
				OK	Cancel	

• Click on the tab **Exchange unit** or **Dosing unit**.

- Select the cylinder volume.
- Enter the number printed on the cylinder under **Cylinder** serial number.
- Confirm the entries with **[OK]**.

The titrant is added to the list of titrants.

# 2.1.4 Configuring a pH electrode

Proceed as follows:



#### 1 Add a pH electrode

In the subwindow Sensors, click on the menu item Edit ► New ► pH electrode....

The properties dialog of the sensor is opened:

#### 2.1 Configuration

nsor -	
Sensor Calibration da	ta Limits History
Sensor name	
Sensor type	pH electrode
Order number	
Sensor serial number	
Device	
Comment	[
Set to work	2008-12-22
Sensor monitoring	
Working life	999 davs
_	
	2011-09-17
Message	
Message by e	
Acoustic signa	I
Action O Record messa	
O Display messa	
O Stop determin	ation
	OK Cancel

# 2 Configure the pH electrode

• On the **Sensor** tab, enter a sensor name and the order number.

s	ensor -			×
ſ	Sensor Calibration da	ata Limits	History	
	Slope	100.0	1 %	
	pH (0)	7.000	)	
	Calibration temperature	25.0	) °C manual	
	Calibration date	2008-12-22 16	6:37:06 UTC+1	
	Calibration method	manual		
	User	jb		
	Measuring input			
	Calibration data mon	itoring		-
	Calibration interval	7	7 days	
	Next calibration	2008-12-29	]	
	Message			-
	Message by e-m	ail	E-mail	
	Acoustic signal			
	Action			-
	O Record message			
	O Display message			
	🔿 Stop determinat	ion		
			OK Cancel	

• Click on the tab **Calibration data**.

- Switch on the option **Calibration data monitoring**.
- Enter a calibration interval of, for example, 7 days.
- Confirm the entries with **[OK]**.

The pH electrode is added to the list of sensors.

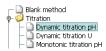
# 2.2 Creating a titration method

Below you will find a description of how to use a template for DET pH titrations to create your own method.

#### Loading the method template

Proceed as follows to load the method template:





## 1 Open the program part "Method"

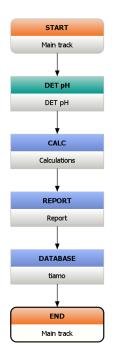
• In the sidebar, click on the symbol [Method].

The method editor is displayed.

#### 2 Select the method template

- Click on the symbol <sup>1</sup> or the menu item
   File ► New....
- Double-click the item **Titration**.
- Select the method template **Dynamic titration pH** and confirm with **[OK]**.

The method is loaded:



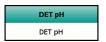
The method template consists of the following commands:

- **DET pH**: Titration command
- **CALC**: Calculation command
- **REPORT**: Command for printing a determination report
- **DATABASE**: Command for saving the determination in the database

The method is now already complete except for a few parameters which you are just going to set.

#### Editing the titration command DET pH

Proceed as follows:



#### **1** Open the properties dialog

Double-click the command **DET pH**.

The properties dialog of the command is opened:

#### 2.2 Creating a titration method

Command name	DET pH		
	ditional evaluations		measured values
General/Hardware Start condit	ons Titration p	parameters	Stop conditions
Device			
Device name	not defined	-	
Device type	Titrando	-	
Dosing device			
Dosing device	1 -		
Solution	not defined	•	
Joiddon		لنا	
Sensor			
Measuring input	1		
Sensor	pH electrode	-	
Temperature measurement	automatic	-	
Stirrer			
Stirrer	1 💌		
Stirring rate	8 💌		
Switch off automatically			
_ ,			
		ОК	Cancel

## 2 General/Hardware

- Under Device name, select the connected Titrando or Titrino.
- Under **Dosing device**, select the MSB connector the dosing device is connected to. Select option **1** if you have attached an exchange unit to the Titrando / Titrino.
- Under **Solution**, select the newly configured titrant.
- Under Sensor, select the previously configured pH electrode.
- Under Stirrer, select the MSB connector the stirrer is connected to.

# 3 Stop conditions

• Click on the tab **Stop conditions**.

×
ns

- Select the option **Stop EP = 1**.
- Under Volume after EP, enter the value 1.
- Confirm the entries with **[OK]**.

#### Editing the calculation command CALC

Proceed as follows:

CALC	
Calculations	

#### 1 Create a new calculation

- Double-click the command **CALC**.
- Click on [New].

The dialog window **New result** is opened:

#### 2.2 Creating a titration method

l	<b>C</b> AL	.C - Calcı	ulati	ions						x
			C	command r	name	Calculations				
	Result name Formula Unit			Decimal places	Assignment	Statistics	Result			
		1		1						
				lew resu			Description			×
			Iem	plates			Description	1		_ h
			Em	pty			Empty dei	ault templa	ate	P
			-				1			
		New	-							-1
L						C	Next >>		Cancel	

In this window predefined result templates can be loaded and modified for new calculations. Because you have not defined a template yet, the selection is empty.

# 2 Define result properties

Click on [Next >>].

The properties dialog for the new result is opened:

Result New	- RSXX	
Definition	Monitoring Op	btions
	Result name	Res01
Formula		
	Unit	
	Decimal places	
	Assignment	R501
🗹 Statis	tics	
Description		
Save as ter	nplate	OK Cancel

• As **Unit**, select the option %.

# **3** Open the formula editor

 Click on the symbol is or double-click the field Formula.

The formula editor is opened:

Formula editor	×
+ - × / ^ = > < <><=>=	AND OR () { } 🔄 🔊 🎮
Variables	Operators/Functions
<ul> <li></li></ul>	© ← Operators ← ← Functions ← ← Miscellaneous
	Description
Add	OK Cancel

The calculation formula is entered in the upper window. Beneath, the most important mathematical functions are listed as symbols.

In the subwindow **Variables** all variables available for this method are listed in a tree-form structure. In the subwindow **Operators/Functions** further mathematical functions can be selected. Additionally, a short description is shown for each variable or function.

The following steps describe how you can enter the simple formula shown below for determining the content of a sample:

#### Formula:

'DET pH.EP{1}.VOL' x 'DET pH.CONC' x 'DET pH.TITER' x 40.00 x 0.1 / 'MV.Sample size'

DET pH.EP{1}.VOL	Volume of the first endpoint
DET pH.CONC	Concentration of the titrant used
DET pH.TITER	Titer of the titrant used

⊙- 🟳 Method variables
- Ommand variables
🔶 🎾 DET pH
- 🗋 TITER
CONC
- 🛄 VOL
MEA

40.00	Equivalent mass of the sample, NaOH as an example here
0.1	Factor for conversion to %
MV.Sample size	Sample size in g

#### 4 Enter the calculation formula

- Under the item Command variables, DET pH, EP{x}, select the variable VOL for the endpoint volume.
- Click on **[Add]**. The variable is added to the formula.
- Replace the x in the variable by 1, i.e. this variable contains the volume of the 1st endpoint.
- Insert the multiplication sign via the corresponding symbol or with the keyboard.
- In the same way insert the variables **CONC** and **TITER**.
- Enter the equivalent mass of the sample as well as the conversion factor.
- Under the item Method variables, select the variable Sample size and click on [Add].
   The variable is added to the formula.
- Confirm the entries with **[OK]**.

The formula editor is closed and the properties window of the result is displayed.

#### 5 Apply the calculation

- Click on [OK]. The calculation is entered in the result table.
- Click on [OK].

The table dialog is closed.

#### **Editing the report command REPORT**

Proceed as follows:



#### **1** Open the properties dialog

Double-click the command **REPORT**.

The properties dialog of the command is opened:

REPORT - Report	X
Command nar	ne Report
Report template	
Report templa	example report
Report output	
Printer	Default printer
DF file	
Send e-mail	E-mail
	OK Cancel

#### 2 Carry out settings

- Switch off the option **Printer**.
- Switch on the option PDF file

The dialog window **Save** is opened.

- Select the memory location, enter the file name and confirm with [Save].
- Confirm the entries with **[OK]**.

The properties dialog is closed.

#### Editing the database command DATABASE

Proceed as follows:



#### **1** Open the properties dialog

Double-click the command **DATABASE**.

The properties dialog of the command is opened:

🖸 DATABASE - tiamo 🔰
Command name tiamo
Database
New Properties Delete
OK Cancel

#### 2 Select database

- Click on [New].
- Select the standard database tiamo and confirm with [OK].
- Click on **[OK]**.

The properties dialog is closed.

The method is now ready and can be checked with a method check and be saved afterwards.

#### **Method check**

Proceed as follows:

#### 1 Start the method check

Click on the symbol ✓ or the menu item File ➤ Method check.

If the method check has been completed successfully, the following message is displayed:

013-11	8 Method test ok	×
1	The method test has been successfully finished.	

#### 2 Finish the method check

• Confirm the message with **[OK]**.

#### Saving the method

Proceed as follows:

#### **1** Open the method table

Click on the symbol □ or the menu item File > Save as....

The following dialog window is opened:

	ve method d group Main	group					×
	Name 🔺	Saved	User	Full name	Version	Signed	
Metho	I name Tutori						►
metho		31			Save	Cance	

#### 2 Enter a method name

As method name, enter **Tutorial** and confirm with [Save].

The method is saved.

# 2.3 Carrying out a titration

# 2.3.1 Preparing the exchange or dosing unit

The **Prepare** function is used to rinse and fill air bubble-free the cylinder and tubings of the exchange or dosing unit. You should carry out this function before the first determination or once per day.

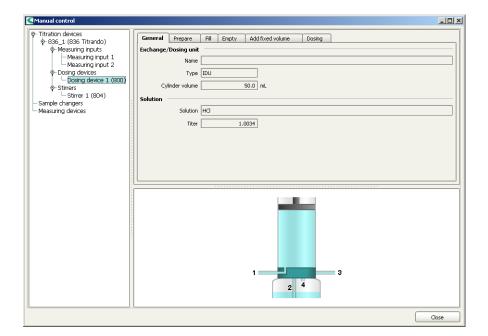
Proceed as follows:



#### 1 Open the manual control

• In the sidebar, click on the symbol [Manual].

#### 2.3 Carrying out a titration

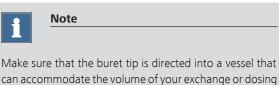


In the left-hand part of the window the control devices connected are listed together with their peripheral devices. In the right-hand part of the window the functions of the device selected are displayed, in this example those of the dosing device.

#### 2 Select the dosing device

- In the left-hand window, select the dosing device whose exchange or dosing unit is to be prepared.
- Click on the tab **Prepare**.

#### **3** Start the preparing



Click on [Start].

unit several times over.

The following message is displayed:



Confirm the message with [Yes].

Preparing is carried out with the default parameters. The parameters can be found in the online help. They are different for exchange and dosing units.

#### 4 Close the manual control

• Close the manual control after the preparing has been completed. Click on **[Close]**.

#### 2.3.2 Carrying out a titration

The titration is carried out in the program part **Workplace**.

🗲 tiamo 2.0 - Workplace				
<u>File Yiew Tools Help</u>				
🎦 🔊 🕐 🗆 📅 🛱 🛯 🗸 🔍 🛄	리 🔠   😨.   🕐			
1 Method		Run		
		Single determina	tion Determination series	
Workplace		▶Start	Stop Hold	Status
workplace		Determination pa	rameters	
		User jb		Sample number 0
		Remark		Sample number 0
		Sample data		
Database		Method		•
1				
Method				
目長日				
Report		Live display 1		
Latest report Select	ed report Report overview			
Configuration				
A III				
00				
Manual				
Press F1 for help				

The program part **Workplace** has the following subwindows:

Method	Display of the method currently loaded.
Run	Window for controlling run sequences and entering sample data.
Report	Display of the reports of the determinations carried out since having started the program.
Live display	Display of live curves, measured values and messages for the determination running.
	Proceed as follows to carry out a titration:



#### 1 Open the program part "Workplace"

• In the sidebar, click on the symbol [Workplace].

#### 2 Load the method

 In the subwindow Run under Method, select the previously created method Tutorial.

Run			
Single dete	rmination	Determination series	
▶ Start	Sto	pp II Hold	Status
Determinat	ion paramet	ers	
User	jb		Sample number 0
Remark			
Sample dat	a		
Method			
	Tutorial	À	
		· //	

## 3 Prepare the sample

- Weigh in the sample in a sample vessel.
- Add solvent.
- Place the sample vessel on the stirrer.
- Immerse electrode and buret tip in solution.

## 4 Enter the sample size

- Enter the sample size (Sample size), e.g. 5.0.
- Select Sample size unit = g.

#### 5 Start the titration

Click on [Start].

The titration is started.

The currently active command is highlighted with a red frame in the subwindow **Method**.



## **Configuring the live display**

While the titration is running, configure the live display the way you can directly follow both the titration curve and the current measured values.

Proceed as follows:

## 1 Open the properties dialog

- Right-click the subwindow Live display. The context menu is displayed.
- Click on the menu item **Properties Live display**.

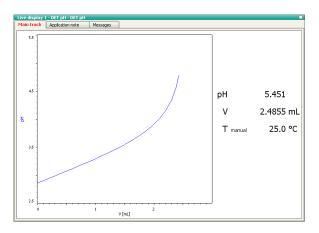
The properties dialog of the live display is opened:

Properties - Live disp	olay 1 🔀
Command type	DET
Measured value	display
Measured value 1	Measured va 💌
Measured value 2	Volume 💌
Measured value 3	Temperature 💌
🗹 Curve display 🚽	
× Axis	Volume 💌
y1 Axis	Measured va 💌 Color 📃 💌
y2 Axis	off 🔹 Color 🗖
Show measurin	g points
Show grid	Background
ОК	Cancel Apply

## 2 Carry out settings

- Switch on the option Measured value display.
- Confirm the entry with **[OK]**.

The live display now looks like this:



With the symbol  $\Box$  in the upper right-hand corner of the live display you can enlarge or reduce the subwindow.

As soon as the determination is finished, a preview of the report is displayed in the subwindow **Report**. Printing out the report is described in the following chapter.

## 2.4 Database

## 2.4.1 Overview



- 1 Open the program part "Database"
  - In the sidebar, click on the symbol [Database].

## 2 Open the database

- Click on the symbol or the menu item
   File ► Open....
- Select the standard database tiamo and confirm with [Open].

<b>tiamo 2.0 - tiam</b> File Edit View I	o Determinations Tools Help							_	
	Decerminations Tools Help	a. 🖳 🕄 🛞 i 🏷 i	Q & & W & &	n n : È 🛢 街 🗷		i 🛍 🕅	?		
1 Det	cermination overview								
Filte	All determinations		[	<ul> <li>Statistics All</li> </ul>					-
	Determination start V	Method name	ID1.Value	R501.Name		R501.Value		RS01.Unit	
Workplace 1	2008-12-23 13:30:09 UTC+1	Tutorial		Res01	0.20		%		
Database									
indenide i									
						]			Þ
	ves 1		Information		Resul		Daw data	Calculations	Þ
	ves 1 T pH.1			ion comment Messages	Resu	lts overview	Raw data	Calculations	
	ves 1		Determinat	ion comment	Resu		-	Calculations	
	Ves 1 T pH.1 12 10 8	P1	Determination Conflouration Determination Identification Generation Recording Determinatio Deter	ion comment Messages	Resu Com Reso	lts overview mand 'Calcula	-	Calculations	

The program part **Database** has the following subwindows:

Determination over- view	List of the individual determinations, sorted according to date and time.
Curves	Display of the titration curve.
Information	General information on the determination such as deter- mination start, method information, sample data, system configuration etc.
Results	Display of the calculated results and the variables used for.

## 2.4.2 Adapting the layout

A short description is given about how to adapt the database view to your own requirements.

#### **Configuring the curve window**

Proceed as follows:

## **1** Open the properties window

- Right-click the subwindow **Curves**. The context menu is displayed.
- Click on the menu item **Properties Curves**.

The properties dialog of the curve is displayed.

### 2 Display grid

• Click on the tab **Options**.

Properties - Curves 1		
Command type DET		
Autoscaling		
x Axis y1 Axis y2 Axis	Options	Measuring point list
Show grid	Bac	kground
Grid type		Background color
Grid color	-	

- Switch on the option **Show grid**.
- Confirm the entries with **[OK]**.

The titration curve is shown with a grid.

#### **Configuring the determination overview**

In the subwindow **Determination overview** you can define which columns are to be shown. You can also freely select the order of the columns.

For example, the columns **User (short name)** and **Remarks** are to be deleted and then the column **Method name** is to be moved.

Proceed as follows:

### 1 Define the column display

■ Click on the menu item View > Properties > Column display.

The following dialog window is opened:

Column display					x
Columns available		Colum	nns displayed		
Determination overview Determination Determination Sethod Sample Results	>>	2 3 4 5 6 7 8 9	Default name Determination start Method name RS01. Value RS01. Value RS01. Value RS01. Junit Sample size. Value Unit: Value User (short name) Remarks	Displayed name Determination start Method name ID1. Value RS01. Name RS01. Value RS01. Value RS01. Unit Sample size. Value User (short name) Remarks	
			ОК	Cancel	)

#### 2 Delete columns

- Under Columns displayed, select the column User (short name).
- Click on the button [<<]. The column is removed from the list.
- Proceed in the same way for the column **Remarks**.
- Confirm the changes with **[OK]**.

The two columns are no longer shown.

#### 3 Move columns

- In the subwindow Determination overview, click on the column title Method name and move this column to the right by holding the mouse button pressed down.
- Insert the column after the column RS01.Unit (Drag & Drop).

## 2.4.3 Reprocessing a determination

A simple example (modify the sample size) illustrates how to recalculate a determination. Proceed as follows:

## 1 Open the dialog window

 Click on the symbol <sup>5</sup> or the menu item Determinations ► Reprocess....

Repro	ocessing		
lodific	ations		Result view
¥aria	bles Method Statistics	Curve evaluation	Results overview Raw data
	Variable 🔺	Value	Command 'Calculations'
▶ 1	DET pH.1.CONC	0.1	Res01: 0.20 %
2	DET pH.1.TITER	0.9985	
3	MV.ID1		
4	MV.ID2		
5	MV.ID3		
6	MV.Sample position	1	
7	MV.Sample size	5.0	
8	MV.Sample size unit	g	
	•	Þ	
		Modify	II → 1 of 1 → >I
Recal	culate Undo		OK Cancel

The following dialog window is opened:

## 2 Modify the sample size

- Under Modifications, select the item MV.Sample size.
- Click on [Modify].

Modil	iy variable	×
Variable	MV.Sample size	
Value		5.0
	OK Cancel	

• As new sample size, enter the value **5.3** and confirm with **[OK]**.

## 3 Start the reprocessing

• Click on [Recalculate].

The progress is shown by a progress bar.

Under **Result view**, the new result is now displayed.

## 4 Finish the reprocessing

Click on [OK].

The recalculated determination is saved as a new version.

## 2.4.4 Printing out a report

The PDF report automatically generated by the determination can be printed out directly from the **Database** program part. Proceed as follows:

## **1** Open the properties dialog

■ Click on the menu item **File** ▶ **Print** ▶ **Report....**.

The properties dialog of the report output is opened:

Report output		×
Selection Selected determina	H	
All filtered determination		
Report type		
<ul> <li>Original report(s)</li> </ul>		
◯ Report template	example report	-
Output target		
Printer	Default printer	-
PDF file		
	OK C	Iancel

## 2 Select a report

• Select the option **Original report(s)**.

## 3 Print the report

• Select the required printer and click on **[OK]**.

The report is printed.



If the determination has been recalculated as in this example, the report of the recalculated determination is printed out.

# **3** Titration with automation

For the second part of this tutorial you require a USB Sample Processor, a rod stirrer and a balance in addition to the titrator.

## 3.1 Configuration

## 3.1.1 Connecting a USB Sample Processor

Proceed as follows to connect a USB Sample Processor:

## 1 Connect the devices

- Connect a stirrer to the stirrer connector of the tower.
- Attach a sample rack.
- Connect the controller connector of the USB Sample Processor with a USB connector on the computer or on the Titrando.
  - Use 6.2151.000 cable.
- Connect the USB Sample Processor to the mains supply.

## 2 Software settings

Start tiamo.

The USB Sample Processor is recognized automatically:



Confirm the message with [Yes].
 The properties dialog of the USB Sample Processor is opened:

Properties - 815 Robotic	USB Sample Processor XL - 815_1
General GLP	
Device name	815_1
Device type	815 Robotic USB Sample Processor XL
Program version	5.815.0024
Device serial number	00002
Set to work	2008-12-23 13:59:13 UTC+1
Remarks	
	OK Cancel

 Under **Device name**, enter a designation that describes the USB Sample Processor unambiguously and confirm with **[OK]**.

The USB Sample Processor is added to the list of devices.

## 3.1.2 Connecting a balance



Proceed as follows to connect a balance:

## 1 Connect the devices

• Connect the balance to the RS-232 interface COM1, COM2, ... of the computer.

#### 3.1 Configuration



Edit 🔻	
New	N
Delete	45
Properties	
Column di	splay
Print (PDF	)
Initialize	
Ignored d	evices

- Connect the balance to the mains supply.
- Switch on the balance.

## 2 Start the software

- Start tiamo.
- In the sidebar, click on the symbol [Configuration].

## 3 Add the device

- In the subwindow **Devices**, click on the menu item **Edit** ▶ **New...**.
- Double-click the item **Balances**.
   The list of the balances available is displayed:

Device selection	×
OK Cancel	Ĵ

• Select the balance from the list and confirm with **[OK]**.

The properties dialog of the balance is opened.

Properties - Sart	orius - 9	iartori	ıs_1			>
General RS	5 232	GLP				
Dev	ice name	Sartor	ius_1			
Dev	vice type	Sartor	ius			
Program	n version					
Device seria	l number					
Sel	t to work	2008-	12-23 14:2	7:09 UTC+1		
		🗌 Dat	a storage	under legal o	ontrol	
	Remarks					
					ж	Cancel

## 4 Configure the device

- Under **Device name**, enter a designation that describes the balance unambiguously.
- Under **Device serial number**, enter the serial number of the balance.
- Click on the tab **RS 232**.

Properties - Sartorius - Sa	rtorius_1
General R5 232 G	LP
COM Port	COM1
Baud rate	9600 💌
Data bit	8 💌
Parity	None
Stop bit	1 💌
Handshake	None
Timeout	2000 💌 ms
Terminator for send	\0D\0A
Terminator for receive	\0D\0A
Code page	Cp437 💌
	Connect
	OK Cancel

- Select the RS-232 interface of the computer the balance is connected to.
- Set the connection parameters. These settings must match the settings on the balance (see manual of the balance).

## 5 Test the connection

Click on [Connect].

The following dialog window is opened:

Establish con	nection 🔀
to test the cor	ne Print button on the connected balance inection. The data will be entered into the ids if the connection is ok.
Device name	
Sample size	Sample size unit
ID1	
ID2	
	OK Cancel

Press the [Print] key on the balance in order to check the connection.

If the correct connection parameters have been entered, the corresponding data is inserted in the fields **Device name**, **Sample size** and **Sample size unit** will be filled in with the corresponding data.

- Click on [OK].
- Confirm the entries with **[OK]**.

The balance is added to the list of devices.

## 3.1.3 Assigning lift positions

In this chapter you will learn how to define lift positions. This is necessary in order to carry out the subsequent titration with the Sample Processor. Proceed as follows:

## 1 Equip the titration head

- Equip the titration head with all necessary accessories such as electrode, dosing tip etc. (see manual of the Sample Processor used).
- Place a sample vessel at position 1 of the rack.



## 2 Open the manual control

• In the sidebar, click on the symbol [Manual].

Manual control		
Fitration devices	General Move Assign position Pump Rack position Current position Target position 1 Lift position	, ▶Start
← Stirrer 1 (804)	Current position 0 mm Ready	Start ▲ ▼
← Surrers 	Current position 68.4 ° Target position 0.0 °	
4	Pump 1 Pump 2	
		Close

In the left-hand part of the window the control devices connected are listed together with their peripheral devices. In the right-hand part of the window the functions of the device selected are displayed, in this example those of the tower of an 815 Robotic USB Sample Processor XL.

#### 3 Select a tower

- In the left-hand window, select the tower of the Sample Processor used.
- Click on the tab **Move**.

## 4 Move to a lift position



After initialization, the Sample Processor is not at a valid rack position. This is displayed with "-----" under **Current position**.

- Under **Rack position**, click on the **[Start]** key or **[▶]**. Sample 1 is moved to.
- Under Lift position, move the life with the keys [▲] and
   [▼].
- Set the lift height to be used as work position, i.e. the electrode is immersed.

#### 5 Assign a work position

Click on the tab Assign position.
 Under Lift position, the current lift height is entered.
 The option Work position for = Tower is preselected.

General Move Assign position Pur	a	
Rack position		
Current position 1	Special beaker	1 Assign
Lift position		
Current position 85 mm	Work position for	Tower
	O Rinse position for	Tower
	<ul> <li>Shift position for</li> </ul>	Tower
	Special position for	Tower
	Swing position	External positions  Assign
Robotic arm position		`
Current position 44.9 °	External position	1 🔹 Assign

• Click on [Assign].

## 6 Assign a shift position

- Click on the tab **Move**.
- With the key [A] move the lift up so far that the rack can freely rotate without damaging the electrode or sample vessels.
- Again, click on the tab **Assign position**.
- Under Lift position, select the option Shift position for = Tower and click on [Assign].

## 7 Assign a rinse position

Define the rinse position in the same way, but with the option Rinse position for = Tower.

## 8 Test the settings

• Click on the tab **Move**.

General	Move	Assign position	Pump			
Rack positi	on —					
Curr	ent positio	n 1				▶ Start
Tar	get positio	n	1 [	<b>~</b>	Ready	
Lift position	י – י					
Curr	ent positio	n		50 mm	Beach	▶Start
Tar	get positio	n	<u>o</u> [	🔺 mm	Ready	
Robotic arr	n positior	<b>۱</b>	Work positi			
Curr	ent positio	n	Rinse positi		<b>D .</b>	▶ Start
Tar	get positio	n	Special positi Home positi		Ready	

Under Lift position, select the option Target position = Work position and press [Start].

The lift now moves to the height that has just been defined.

• Check the shift and rinse position in the same way.

## 3.1.4 Defining special beakers

Special beakers are particular rack positions which can be used, for example, as rinsing or conditioning beakers. Special beakers are preferably set at high rack positions so that sample series can start from rack position 1. Lift positions must be separately assigned for special beakers.

Proceed as follows:

#### 1 Move to a rack position

- Click on the tab **Move**.
- Under Rack position, enter the required position and click on [Start].

The rack position is moved to.

## 2 Assign a rack position

 Click on the tab Assign position. Under Rack position, the current position is entered. The option Special beaker = 1 for the first special beaker is preselected.

General Move Assign position Pu	imp	
Rack position		
Current position 142	Special beaker	1 Assign
Lift position		
Current position 20 mm	Work position for	Tower
	O Rinse position for	Tower
	O Shift position for	Tower
	O Special position for	Tower
	Swing position	External positions 💌 Assign
Robotic arm position		
Current position 57.8 °	External position	1 💭 Assign

• Click on [Assign].

## 3 Test the settings

- Click on the tab **Move**.
- Under Rack position, click on the key [▶]. The next sample position is moved to.

General Move ,	Assign position	Pump			
Rack position					
Current position	1		]	Deeds	▶Start
Target position		142 🔺	]	Ready	
Lift position	R	Special beaker 1 📥			
Current position	- ~~	Special beaker 2 Special beaker 3	mm		▶ Start
Target position		Special beaker 4	mm	Ready	
Robotic arm position		Special beaker 5 Special beaker 6			
Current position		Special beaker 7		_	
Target position		Special beaker 8 👻 0.0 👻		Ready	▶ Start
			-		

Under Rack position, select the option Target position = Special beaker 1 and click on [Start].

The rack position that has just been defined will be moved to.

## 4 Move to a lift position

- Under Lift position, move the life with the keys [▲] and
   [▼].
- Set the lift height to be used as work position, i.e. the electrode is immersed.

## 5 Assign a work position

Click on the tab Assign position.
 Under Lift position, the current lift height is entered.

General Move Assign position Pum	P	
Rack position		
Current position 142	Special beaker	1 🚔 Assign
Lift position		
Current position 85 mm	Work position for	Tower
	Rinse position for	Tower
	-	Special beaker 1
	Shift position for	Special beaker 2 K
	O Special position for	Special beaker 3 Special beaker 4
	Swing position	Special beaker 5 Assign
		Special beaker 6
Robotic arm position		Special beaker 7
Current position 57.8 °	External position	1 Assign

 Under Lift position, select the option Work position for = Special beaker 1 and click on [Assign].

## 6 Test the settings

- Click on the tab **Move**.
- Under Lift position, click on the key [▲] or [▼]. The lift is moved.
- Under Lift position, select the option Target position = Work position and press [Start].

The lift now moves to the height that has just been defined.

- 7 Close the manual control
  - Click on [Close].

## 3.2 Creating an automation method

The method created in part 1 is now to be extended to an automation method so that a sample series with 3 samples can be automatically processed.

i	N

Note

It is assumed that a Sample Processor with *one* tower is used for creating the automation method.

## 3.2.1 Loading the method

Proceed as follows:



## 1 Open the program part "Method"

• In the sidebar, click on the symbol [Method].

The method editor is displayed.

- 2 Open the method
  - Click on the symbol or the menu item
     File ► Open....
  - Select the method **Tutorial** and confirm with [Open].

The method is loaded.

#### Meaning of the individual commands

The following commands are required for a simple automation method:



LIFT Lift With the command **MOVE** a rack position or an external position (with Swing Head only) is moved to.

With the command LIFT the lift is moved to the required height.





With the command **STIR** a stirrer connected to the Sample Processor is switched on or off.

With the command **PUMP** an internal or external pump on the Sample Processor is switched on or off.

## 3.2.2 Extending the titration method

#### Moving to the first sample

In front of the titration command **DET pH**, insert a command to move to the first sample. Proceed as follows:

ə- 💋	Titration
þ- 🥑	Measure
þ- 🧀	Calibration
>- 🥥	Dosing
þ- 🂋	Automation
	MOVE SWING

#### 1 Insert the command MOVE

- Select the command **DET pH**.
   The command is shown in a black frame.
- Click on the symbol <sup>\*</sup>→ or the menu item Insert > New command....
- Double-click the item **Automation**.
- Select the command MOVE and confirm with [OK].

The command is inserted in front of the titration command **DET pH**.

MOVE
Move

## **2** Open the properties dialog

Double-click the command **MOVE**.

The properties dialog of the command is opened:

<b>MOAE</b>	- Move		×
	Command name	Move	
Device	Device name	not defined	
	Device type	814 USB Sample Processor 💌	
Target	Tower	1	
	Move	Sample position	
Beake	rtest		_
۲	Display message		
<ul> <li>Stop determination</li> </ul>			
0	Stop determinatio	n and series	
Parame	eters		
	Shift rate	20 °/s	
	Shift direction	auto	
	Swing rate	55 °/s	
		OK Cancel	

## 3 Carry out settings

Under **Device name**, select the Sample Processor connected.

The other parameters are already set correctly and do not need to be modified.

• Confirm the entry with **[OK]**.

#### Moving the lift to the work position

After the command **MOVE**, insert a command to move the lift to the work position. Proceed as follows:

#### 1 Insert the command LIFT

- Select the command **DET pH**.
   The command is shown in a black frame.
- Click on the symbol <sup>\*</sup>→ or the menu item Insert > New command....
- Double-click the item **Automation**.
- Select the command LIFT and confirm with [OK].

The command is inserted in front of the titration command **DET pH**.

• Double-click the command LIFT.

🔇 LIFT - Lift	×	
Command name	Lift	
Device		
Device name	not defined 💌	
Device type	814 USB Sample Processor 💌	
Target		
Tower	1	
Lift position	Work position 💌 mm	
Parameters		
Lift rate	25 mm/s	
	OK Cancel	

LIFT
Lift

Under **Device name**, select the Sample Processor connected.

The other parameters are already set correctly and do not need to be modified.

• Confirm the entry with **[OK]**.

## Switch on the stirrer

After the command **LIFT**, insert a command to switch on the stirrer. Proceed as follows:

## 1 Insert the command STIR

• In the same way, after the command **LIFT**, insert the command **STIR**.

STIR	
Stir	

## 2 Open the properties dialog

Double-click the command **STIR**.

STIR	- Stir		x
	Command name	Stir	
Device			
	Device name	not defined	
	Device type	814 USB Sample Processor 🛛 💌	
Stirrer			
	Stirrer	1	
	Stirrer type	unknown	
	Stirring rate	8 💌	
Action			
<ul> <li>Switch on</li> </ul>			
<ul> <li>Switch off</li> </ul>			
0	Duration	10.0 min 💌	
		OK Cancel	

Under **Device name**, select the Sample Processor connected.

The other parameters are already set correctly and do not need to be modified.

• Confirm the entry with **[OK]**.

#### 4 Edit the titration command



As the stirrer is controlled by the command STIR, it must be switched off in the titration command **DET pH**.

- Double-click the command **DET pH**.
- On the General/Hardware tab under Stirrer, select the option Stirrer = off.
- Confirm the entry with **[OK]**.

#### Switching off the stirrer

After the command **DATABASE**, insert a command to switch off the stirrer after the titration finished. Proceed as follows:

#### 1 Insert the command STIR

• After the command **DATABASE**, insert the command **STIR**.

STIR	
Stir	

## 2 Open the properties dialog

Double-click the command STIR.

STIR - Stir	X
Command name	Stir
Device	
Device name	not defined 💌
Device type	814 USB Sample Processor
Stirrer	
Stirrer	1
Stirrer type	unknown
Stirring rate	8 💌
Action	
<ul> <li>Switch on</li> </ul>	
<ul> <li>Switch off</li> </ul>	
O Duration	10.0 min 💌
	OK Cancel

- Under **Device name**, select the Sample Processor connected.
- Under Action, select the option Switch off.
- Confirm the entries with **[OK]**.

#### Rinsing

In the following steps you will insert the commands in order to rinse the electrode, dosing tip and stirrer in special beaker 1. Proceed as follows:

1	Insert	the	command	MOVE

- After the command **STIR**, insert the command **MOVE**.
- Double-click the command **MOVE**.

The properties dialog of the command is opened.

## 2 Carry out settings

 Under Device name, select the Sample Processor connected.

MOVE	
Move	

- Under Target, select the option Move = Special beaker. The option Number = 1 is preselected for the first special beaker.
- Confirm the entries with **[OK]**.

#### 3 Insert the command LIFT

- After the command **MOVE**, insert the command **LIFT**.
- Double-click the command LIFT.

The properties dialog of the command is opened.

## 4 Carry out settings

- Under Device name, select the Sample Processor connected.
- Under Target, select the option Lift position = Rinse position.
- Confirm the entries with **[OK]**.

F	PUMP
F	Pump

#### 5 Insert the command PUMP

- After the command **LIFT**, insert the command **PUMP**.
- Double-click the command **PUMP**.

SPUMP - Pump	×
Command name	Pump
Device	
Device name	not defined 💌
Device type	814 USB Sample Processor 💌
Pumps	
Tower	1 💌
Pump(s)	1 💌
Action	
<ul> <li>Switch on</li> </ul>	
<ul> <li>Switch off</li> </ul>	
O Duration	10.0 s 💌
	OK Cancel



- Under **Device name**, select the Sample Processor connected.
- Under Pump, select the option Pump(s) = 1+2. With built-in pumps, pump 1 is used for rinsing the titration head and pump 2 is used for aspirating the solution so that the special beaker does not overflow.
- Under Action, select the option **Duration** = **3** s.
- Confirm the entries with **[OK]**.

## 7 Edit method properties

Double-click the command **START**.

The properties dialog of the command is opened:

	Command	name Main track		
General	Application note	Method variables		
Workplac	e view			
Cur	rent view			
O Vie	w [		<b>v</b>	
0 110				
Track vie	w for live window 👘			
	Live dis	splay 1 Main track	-	
	Live dis	splay 2 Main track	-	
_				
Statis	itics			
Nu	umber of single determin	nations not defined 💌		
Condition	ing			
🗹 Au	omatic conditioning			

#### 8 Switch on statistics

- Switch on the option **Statistics**.
- Enter the number of determinations to be carried out, in this example **3**.
- Confirm the entries with **[OK]**.

The method is now ready and can be checked with a method check and be saved afterwards.

#### **Method check**

Proceed as follows:

#### 1 Start the method check

Click on the symbol ✓ or the menu item File ➤ Method check.

If the method check has been completed successfully, the following message is displayed:



## 2 Finish the method check

• Confirm the message with [OK].

#### Saving the method

Proceed as follows:

## 1 Open the method table

■ Click on the menu item **File** ► **Save as...**.

The method table is opened.

#### 2 Enter a method name

 As method name, enter Tutorial Automation and confirm with [Save].

The method is saved.

## **3.3 Performing a sample series**

## 3.3.1 Creating a sample table

You will now create a sample table in order to carry out a series of three determinations fully automatically. In a second step you will configure the sample table the way the sample size is directly transferred from the balance to the sample table. Proceed as follows:



## 1 Open the program part "Workplace"

• In the sidebar, click on the symbol [Workplace]

## 2 Open the sample table

In the subwindow Run, click on the tab Determination series.

Run						
Single determination	Determinati	on seri	es 🗋			
▶Start Stop IIHold IIPause Status						
Determination para	meters					
User jb					Sam	ple number 0
Remark						<b>_</b>
Autostart 0	of Sample table	•			🗌 Statist	ics 0 of 3
Sample data						
	a 🗤 🛣 i 🗗					
Method	Sample position	ID1	ID2	ID3	Sample size	Sample size unit
•						
€dt ▼ Sample table ▼ Loaded						

## **3** Open the entry dialog

• Under **Sample data**, double-click the highlighted line.

#### 3.3 Performing a sample series

🤇 Edit line - We	orking sample table - Workplace Workplace 🔀
Method	
Sample position	1
ID1	
ID2	
ID3	
Sample size	1.0 Sample size unit g
Line H	1 > > > > > > > > > > > > > > > > > > >
🗌 Display app	lication note

The entry dialog for the individual samples is opened:

- 4 Enter the sample data for the first sample
  - Under Method, select the previously created method Tutorial Automation.
  - Under ID1, enter a sample identification for the first sample, e.g. Sample 1.
  - Click on the symbol

The data is entered in the first line of the sample table. A second line is automatically added to the table. The method and the sample identification are copied. The sample position is increased automatically.

#### 5 Enter the sample data for the samples 2 + 3

- Modify the sample identification for the second sample, e.g. Sample 2.
- Click on the symbol L.

The data is entered in the second line of the sample table.

- In the same way, modify the sample identification for the third sample.
- Confirm this last entry with [Apply].

## 6 Close the entry dialog

Click on [Close].

In the next step you will configure the sample table the way the sample size is automatically transferred to the sample table.

### **Configuring the sample table**

Proceed as follows:

## **1** Open the properties dialog

In the subwindow Run, click on the menu item Sample table ► Properties....

The properties dialog of the determination series is opened:

Properties - Determination	i series			×
Display Edit Proces	s Data impor	t Comment		
Accept data with	Sar	nple size	-	
Lock editing in working s	ample table			
Copy automatically into	next line			
Method	🗹 ID1	☑ ID2	🗹 ID3	🗆 ID4
Sample size	🗌 ID5	ID6	🗌 ID7	🗆 ID8
🗹 Sample size unit	ID9	🗌 ID10	🗌 ID11	🗌 ID12
Sample position + 1	🗌 ID13	🗌 ID14	🗌 ID15	🗆 ID16
			ОК	Cancel

## 2 Define the data entry

• Click on the tab **Edit**.

	Sample table 🔻
	New
	Load
	🚽 Save
	Save as
	🛃 Sample table test
	PDF Print (PDF)
	Properties
	Import data 🔨
	🎝 Reset
1	

 Switch on the option Accept data with. Sample size is preselected.

If this parameter is switched on then a switch will be made to the next line as soon as the sample size has been transferred from the balance to the selected sample line.

• Click on the tab **Data import**.

Display	Edit	Process	Data import	Comment			
Impo	rt from b	alance					
	Balance	Sartorius_	1	•			
		O Always	accept data				
		O Accept	data only for acti	ze window			
		Confirm	iation necessary t	o accept data	during determin	ation	
🗌 Impo	rt from b	arcode rea	der				
Barco	de reader			-			
		O Always	accept data				
		O Accept	data only for acti	/e window			
		Confirm	ation necessary t	o accept data	during determin	ation	
Impo	rt from fi	le					
1	Import file						
Imp	ort format	*.csv		·			

- Switch on the option **Import from balance**.
- Select the balance connected.
- Confirm the entries with **[OK]**.

Sample table 🔻
New
Load
🚽 Save
Save as
💱 Sample table test"
PDF Print (PDF)
Properties
Import data
🏠 Reset

#### 3 Save the sample table

- In the subwindow Run, click on the symbol □ or the menu item Sample table > Save as....
- As name, enter **Tutorial** and click on **[Save]**.

The sample table is saved.

## 3.3.2 **Performing a sample series**

Proceed as follows:

## 1 Prepare the sample

- Select the first line of the sample table.
- Weigh in the sample in a sample vessel.
- Add solvent.
- Press the [Print] key on the balance.

The sample size is inserted in the first line. The line for sample 2 is highlighted:

Run								
Sing	Single determination Determination series							
	Start Stop IIHold IIPause Status READY							
Det	ermin	ation para	meters					
	Us	er jb					San	ple number 0
	Rema	ark 📃						-
	Autosta	art 🛛 (	of Sample table	-			🗹 Statist	ics 0 of 3
San	nple da	ata						
		E 🏹 I 🖣	🗄 🐓 🐺 I 🕹					
		Method	Sample position	ID1	ID2	ID3	Sample size	Sample size unit
	1	Tutorial	1	Sam			4.8694	g 🗅
	▶ 2	Tutorial	2	Sam				g
	3	Tutorial	3	Sam				g 🚺
	*	_						
		•						
	E	idit 🔻	Sample table 🔻	Load	ed 🗌			

### 2 Prepare the sample 2 and 3

• In the same way, prepare the second and third sample.

#### **3** Place the samples on the rack

• Place the samples at positions 1 to 3 on the rack.



#### Note

Under **Determination parameters**, the option **Autostart = Sample table** is selected by default. This means that the whole sample table will be processed. If you wish to only partly process the sample table, then simply enter the corresponding number of samples here.

▶Start

#### 4 Start the titration

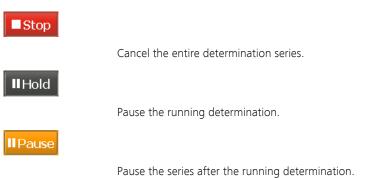
Click on [Start].

The titration is started.

In the sample table the current sample is highlighted in orange, samples that have already been processed are shown with a gray background:

Run								
Single	det	ermination	Determination series					
			Hold HP	ause				Status BUSY
Deter		ation parameter	15					
		ser jb						Sample number 2
	Rem							
	itost		Sample table 💌					Statistics 2 of 3
Samp								
L.	18	0 S)   🖻 🛟	Σ Ι 🐶	_				
		Method	Sample position	ID1	ID2	ID3	Sample size	Sample size unit
	1	Tutorial Autom	1	Sample 1			4.8694	g
L	2	Tutorial Autom	2	Sample 2			5.1236	g
L	3	Tutorial Autom	3	Sample 3			4.8469	g
1	*							
		4						Þ
Ē		Edit 🔻 🛛 Sa	mple table 🔻 Loaded	Tutorial (modifi	ied)			
	_							

Now the titration runs automatically. The following buttons allow manual intervention:



## 3.3.3 Displaying statistics results

Proceed as follows to display the statistics results of a sample series:



-----

## 1 Open the program part "Database"

- In the sidebar, click on the symbol **[Database]**.
- 2 Open the database
  - Click on the symbol or the menu item
     File ► Open....
  - Select the standard database tiamo and confirm with [Open].

#### 3.3 Performing a sample series

tiamo 2.0							_ 🗆 🗵
File Edit V	iew Determinations Tools Help ]   🕵   🗈   🔗   🖽 🚰 B	*	5 🏹 🏆 🖌 🍹 🗈 🖻 🗉 🗄		ZI 🕐 - 🕲 - 📬	o)	
	Determination overview					- U	
	Filter All determinations		Statistics				-
K.V.							
	Determination start ▼ 1 2008-12-23 16:25:43 UTC+1	Method name Tutorial Automation Sam	ID1.Value ple 3 Res01	R501.Name	R501.Value 0.21	R501.Ur	iit
Workplace	2 2008-12-23 16:23:43 UTC+1				0.19	%	
	2 2008-12-23 16:23:45 UTC+1 3 2008-12-23 16:21:35 UTC+1				0.21	%	
	5 2000 12 25 10:21:05 01011		10001		0.21	~~	
Database							
Π							
Method							
1:4:1:	14 4 1-3 of 3						•
	Curves 1		nation		Results		
<b>T</b> :  :  : ]	DET pH.1		Determination comment		Results overview	Raw data Calculat	ions
Configuration			Configuration	Messages			
	DET pH	De	termination Method	Sample	Command 'Calculat Res01: 0.21 %	ions'	
		Iden	tification		Resul: 0.21 %		
	10		Determination ID:	15547f77:11e6			
			Server name:	127.0.0.1			
	8	-EP1	Client name: j	ь-2			
	E		Sample number: 3	3			
	6		Start counter:	5			
		Reco	rding				
	4		Determination start: 2	2008-12-23 16:2			
			Determination duration:	103 s			
1 Carl	2		Determination run:				
20	0 1 2		User (short name): j				
Manual	V [r	nL] (	1111				
Press F1 for he	e e	2 B					

## **3** Open the properties window

- Right-click the subwindow **Results**. The context menu is displayed.
- Click on the menu item **Properties Results**.

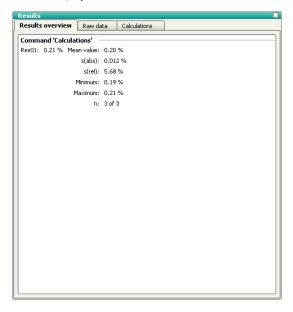
The properties dialog for the result view is displayed.

Properties result window	X
Display for results overview	_
Results	
Statistics	
Display for calculation commands	_
Results	
Statistics	
Assignment	
🗹 Formula	
Variables	
OK Cancel	

#### 4 Show the statistics data

- Switch on the option **Statistics**.
- Confirm the entry with **[OK]**.

In the subwindow **Results**, the statistics data for the sample series is displayed:



## 3.4 Extending the automation method

A samples series is processed in the following three phases:

- 1. **Start sequence**: Commands that are carried out once at the start of a sample series.
- 2. **Sample sequence**: Commands that are carried out for each sample.
- 3. **End sequence**: Commands that are carried out once at the end of a sample series.

In *tiamo<sup>TM</sup>*, these single sequences can be subdivided into **part sequences**, the so-called **tracks**. Each track contains a START and an END command which cannot be deleted. Any commands can be inserted between them.

-----

In the following steps the automation method that has just been created will be correspondingly modified.



#### Note

The method will be programmed the way the electrode will be stored in a beaker filled with conditioning solution at the end of the sample series. A second special beaker has to defined for this purpose (*see Chapter 3.1.4, page 48*).

#### **Creating a series start track**

Create a series start track and insert a command resetting the Sample Processor to normal status at the start of the sample series. Proceed as follows:



## 1 Open the program part "Method"

• In the sidebar, click on the symbol [Method].

The method editor is shown.

#### 2 Open the method

Click on the symbol or the menu item

#### File ► Open....

Select the method Tutorial Automation and confirm with [Open].

The method is loaded.

	Normal track
$\left  - \right $	Series start track
$\left  - \right $	Series end track
$\left  - \right $	🗋 Exit track
L	🗋 Error track

## 3 Create a series start track

- Click on the symbol <sup>™</sup> or the menu item Insert ▶ New track....
- Select the item Series start track and confirm with [OK].

A new, empty track will be inserted beside the previous track.

## 4 Initialize the Sample Processor

- Click on the symbol <sup>\*</sup> or the menu item Insert ► New command....
- Double-click the item **Automation**.
- Select the command **RACK** and confirm with **[OK]**.
- Double-click the command **RACK**.

The properties dialog of the command is opened:

RACK - Initialize rack		×
Command name	Initialize rack	
Device		-
Device name	not defined 💌	
Device type	814 USB Sample Processor 💌	
Rack test		-
Test rack	6.2041.410	
	OK Cancel	

- Under **Device name**, select the Sample Processor connected.
- Confirm the entry with **[OK]**.

#### **Creating a series end track**

Create a series end track and insert commands to store the electrode in special beaker 2 (filled with conditioning solution). Proceed as follows:

RACK Initialize rack



#### Note

Make sure a rack position is defined as special beaker 2.

## 1 Create a series end track

- Click on the symbol **Z** or the menu item **Insert** ► **New track...**.
- Select the item Series end track and confirm with [OK].

A new, empty track will be inserted beside the previous track.

#### 2 Move to the special beaker

- Insert the command **MOVE**.
- Double-click the command MOVE.
   The properties dialog of the command is opened.
- Under Device name, select the Sample Processor connected.
- Under Target, select the option Move = Special beaker.
- Under **Number**, enter **2** for the second special beaker.
- Confirm the entries with **[OK]**.

### 3 Move to the work position

- After the command **MOVE**, insert the command **LIFT**.
- Double-click the command LIFT. The properties dialog of the command is opened.
- Under **Device name**, select the Sample Processor connected.

The other parameters are already set correctly and do not need to be modified.

• Confirm the entry with **[OK]**.

MOVE
Move

LIFT	
Lift	

#### 4 Method check

• Check the method modified with a method check.

#### 5 Save the method

 Save the method under the name Tutorial Automation extended.

#### Adapting the sample table

Finally assign this new method to the individual samples of the previously created sample table (*see Chapter 3.3.1, page 61*). Proceed as follows:

## 1 Open the program part "Workplace"

• In the sidebar, click on the symbol [Workplace].

Sample table 🔻	
New	
Load	
🔚 Save 📉	
Save as	
🛃 Sample table test	
PDF Print (PDF)	
Properties	
Import data	
🎝 Reset	

## 2 Load the sample table

- In the subwindow Run, click on the menu item Sample table ► Load....
- Select the sample table **Tutorial** and confirm with [Load].

The sample table is loaded.

## 3 Assign the method

- Under Sample data, double-click the first line. The entry dialog is opened.
- Under Method, select the previously created method Tutorial Automation extended.
- Click on the symbol

- In the same way, modify the method for the second and third sample.
- Confirm this last entry with [Apply].
- Click on [Close].

## 4 Save the sample table

Save the sample table under the name **Tutorial extended**.

A sample series can now be carried out with the extended automation method and the correspondingly modified sample table (*see Chapter 3.3.2, page 65*).