

移液设备 · 简单操作！



Titrette® 数字滴定器

A级精准度

F I R S T C L A S S · B R A N D



3 操作手册

35 Operating Manual





EG-Konformitätserklärung EC-Conformity Declaration

Das bezeichnete Gerät entspricht den einschlägigen Anforderungen der aufgeführten EG-Richtlinien und Normen. Bei einer nicht mit uns abgestimmten Änderung des Gerätes verliert die Erklärung ihre Gültigkeit.

The device named below fulfills the relevant fundamental requirements of the EC directives and standards listed. In case of unauthorized modifications to the device, the declaration becomes invalid.

Gerätebezeichnung / Device name: Titrette®
manuelle Flaschenaufsatzbürette mit LCD-Anzeige
manual bottle-top buret with LCD display

Gerätetyp / Device type: alle baugleichen Varianten
all constructional identical variants

Hersteller / Manufacturer: BRAND GMBH + CO KG

Adresse / Address: Otto-Schott-Str. 25
97877 Wertheim · Germany

Einschlägige EG-Richtlinien/Normen · Relevant EC directives/standards:
2004/108/EG: EN 61326-1:2006
2006/95/EG: EN 61010-1:2001

Wertheim, 01. März 2011 / March 01, 2011

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安全指导

这台仪器可能会与有害的材料，操作或设备一起使用。本手册不可能提示这些应用中所有的潜在安全风险。使用者有责任在使用前咨询并进行恰当的安全与健康练习，并决定规章限制的适用性。

请仔细阅读下面的提示！

1. 在使用前每位使用者必需阅读并理解本操作手册。
2. 遵循有害防护与安全指导的通用规章；比如，穿着防护服，佩戴防护镜与手套。
3. 遵守试剂供应商的相关信息。
4. 禁止在有爆炸风险的空气中使用本仪器。
5. 本仪器仅适用于液体滴定，需严格按照使用与操作限制使用。请遵守“禁止操作”指导（参见第5页）！如有疑问，请联络厂方或经销商。
6. 确保操作不伤害使用者或者其他人员。避免溅撒。只能使用合适的容器。
7. 滴定管盖关闭时不可以旋转滴定旋钮。
8. 玻璃活塞腔灌满时决不可拆除滴定管。
9. 试剂可能会积聚在滴定管的管盖内。因此，应该定期清理。
10. 当使用较小的试剂瓶时，请使用合适的试剂瓶底座以防翻倒。
11. 安装在试剂瓶上的滴定器绝不可握着外壳移动。滴定器的意外破裂或与试剂瓶的意外分离可能会导致伤害。
12. 绝对不可野蛮操作此仪器。
13. 请使用原厂零备件与附件。请不要尝试替换任何部件。不要进行超过本操作手册描述范围的拆卸！
14. 使用前请检查仪器有无可见损伤。如果仪器在操作时有潜在的故障迹象（比如，活塞移动困难，阀门黏住或泄漏），请立即停止滴定。咨询本手册的“故障诊断”（参见32页），有必要的话请联系供应商。
15. 随机附赠的1.5 V微电池不可充电！

功能与使用限制

数字显示瓶口滴定器Titrette® 适用于水相或非水相介质（如乙醇氢氧化钾）滴定，最大浓度至1 mol/l（参见第5页建议应用范围）。仪器附含根据ISO 8655-3计量要求的Conformity质保认证。由于采用高精度测量系统，本仪器可达到相当于A级玻璃滴定管要求的容差范围。当正常操作时，液体只会接触以下耐腐蚀材料：硼硅玻璃， Al_2O_3 ，ETFE，PFA，FEP，PTFE，铂-铱；PP(旋盖)。仪器自带回流阀（工厂默认配置）。



此标志证明本产品符合EEC指令相关要求并通过了相应的测试。

极限工作条件

该装置为液体试剂的滴定而设计，请遵循以下物理极限：

- 装置及试剂温度范围+15 °C 至 +40 °C
- 最大蒸汽压至500 mbar
- 最大黏度至500 mm²/s
- 最大海拔至3000 m
- 相对湿度范围: 20% 至90%

禁止操作

永远不要将本仪器用于

- 攻击硼硅玻璃, Al₂O₃, ETFE, PFA, FEP, PTFE, 或铂-铱的液体 (比如, 氢氟酸)
- 悬浊液 (比如, 活性炭), 因为固体颗粒可能会堵塞或损坏仪器。
- 浓酸, 浓碱以及可能导致塑料溶胀的非极性有机溶剂 (比如, 甲苯与苯)。
- 二硫化碳, 因为此物质极易燃烧
- 本仪器不可高压灭菌!

推荐应用范围

设备可用于以下滴定试剂 (最大浓度1 mol/l):

试剂

Acetic acid 乙酸	Iron (II) sulfate solution 硫酸亚铁溶液	Silver nitrate solution* 硝酸银溶液*
Alcoholic potassium hydroxide solution 氢氧化钾-乙醇溶液	Nitric acid 硝酸	Sodium arsenite solution 亚砷酸钠溶液
Ammonium iron (II) sulfate solution 硫酸亚铁氨溶液	Oxalic acid solution 草酸溶液	Sodium carbonate solution 碳酸钠溶液
Ammonium thiocyanate solution 硫氰酸铵溶液	Perchloric acid 高氯酸	Sodium chloride solution 氯化钠溶液
Barium chloride solution 氯化钡溶液	Perchloric acid in glacial acetic acid 高氯酸-冰醋酸	Sodium hydroxide solution 氢氧化钠溶液
Bromide bromate solution 溴酸盐溶液	Potassium bromate solution 溴酸钾溶液	Sodium nitrite solution 亚硝酸钠溶液
Cerium (IV) sulfate solution 硫酸铈 (IV) 溶液	Potassium bromate bromide solution 溴化钾溶液	Sodium thiosulfate solution 硫代硫酸钠
EDTA solution EDTA溶液	Potassium dichromate solution 重铬酸钾溶液	Sulfuric acid 硫酸
Hydrochloric acid 盐酸	Potassium hydroxide solution 氢氧化钾溶液	Tetra-n-butylammonium hydroxide sol. 四丁基氢氧化铵
Hydrochloric acid in Acetone 盐酸-丙酮	Potassium iodate solution 碘酸钾溶液	Triethanolamine in Acetone* 三乙醇胺-丙酮*
Iodine solution* 碘液*	Potassium permanganate solution* 高锰酸钾溶液*	Zinc sulfate solution 硫酸锌溶液
Iodide iodate solution* 碘化碘酸盐溶液*	Potassium thiocyanate solution 硫氰酸钾溶液	

* 使用光敏保护观察窗 (参见12页)。

以上推荐均建立在已发表的实验结果之上 (0411/4更新)。以上推荐均建立在已发表的实验结果之上。请始终遵守仪器的操作手册及试剂供应商的操作规范。如您使用的试剂未列于上表, 请向BRAND咨询。

使用限制

氯化或氟化烃以及一些会形成沉淀的试剂可能会使活塞移动困难或者导致堵塞。

如使用易沉淀结晶的试剂, 请按照清洁指导进行 (参见22 - 25页)。

在进行特殊应用 (例如, 痕量物质分析) 时, 用户需确认试剂与本设备的兼容性。详情请联系供应商。

电池规格

两块微电池, 1.5 V (AAA/UM4/LR03), 不可充电。

储存条件

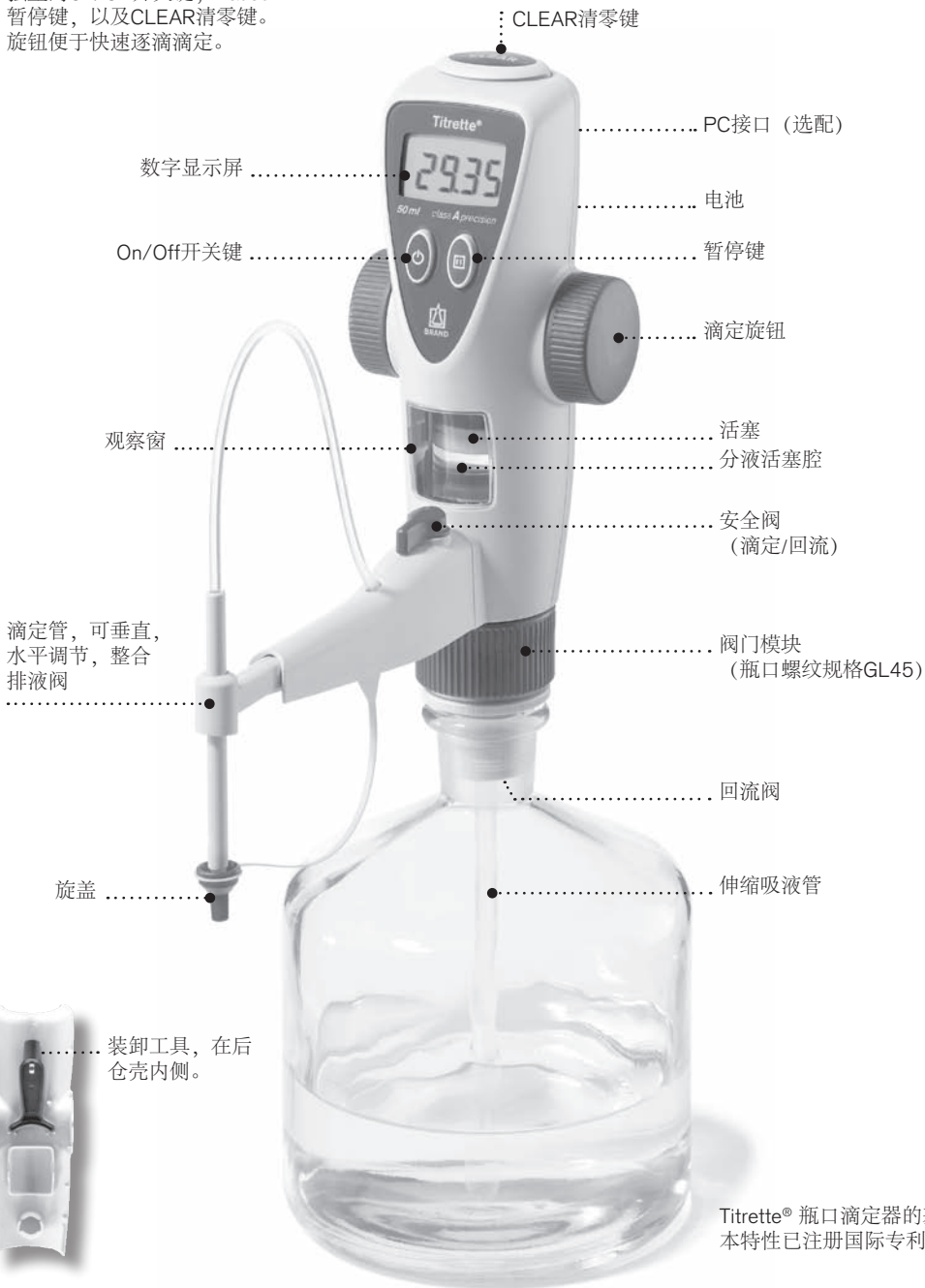
请将仪器放置在清洁干燥的环境下。

储存温度: -20 °C 至 +50 °C,
相对空气湿度: 5% 至 95%。

操作原件

控制方式:

独立的On/Off开关键, Pause
暂停键, 以及CLEAR清零键。
旋钮便于快速逐滴滴定。



Titrette® 瓶口滴定器的基本特性已注册国际专利。

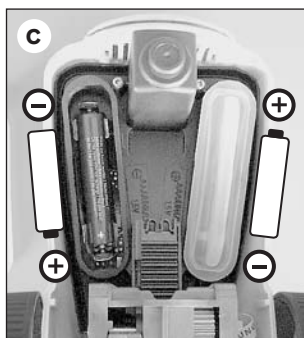
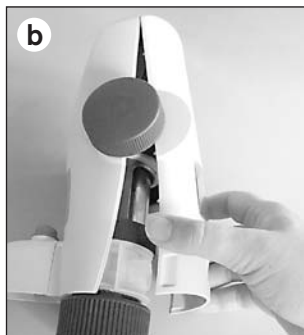
所有的组件都在包装内吗？

确认您的包装盒内有：Titrette® 瓶口滴定器，规格25ml或者50ml；伸缩吸液管（长度170 - 330 mm）；回流管；2个微电池 1.5 V (AAA/UM4/LR03)；3个PP材质瓶口转接头（GL45/32, GL45/S40, GL32/NS 29/32）；2个茶色观察窗；性能证书；以及本说明书。

开始

1. 装入电池

- 用手或者一枚硬币旋开后通气盖（图a）。
- 打开后仓壳（图b）。
- 打开电池仓盖插入电池。注意电池的正负极方向（图c）。
- 盖上电池仓盖插。小心按压仓盖边缘以使前后仓结合紧密，不留任何间隙。
- 首先将前后仓顶部扣住，然后阖上前后仓壳。
- 旋上后通气盖。



2. 打开/关闭电源

按On/Off键打开或关闭仪器。



第一步

开始 (续)

注意：

请穿戴防护服，保护镜和手套。遵循所有的安全指导和操作限制（见第5页）。

- 3. 安装吸液管与回流管** 根据试剂瓶高度调节吸液管，插入吸液管。插入回流管，开口朝外(图3)。

提示：

对于易结晶的试剂，例如：乙醇KOH，吸液管长度需要调整至距底部约20 mm左右。

- 4. 安装对齐滴定器** 将滴定器拧至瓶口（GL45螺纹），调整滴定管与试剂瓶标签对齐。对于其他螺口规格的试剂瓶，选择合适的接头。滴定管可以垂直或水平调节70 mm(图4)。

提示：

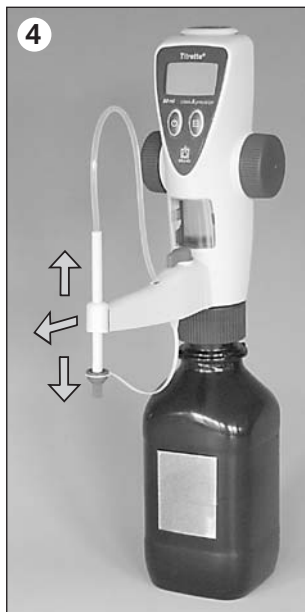
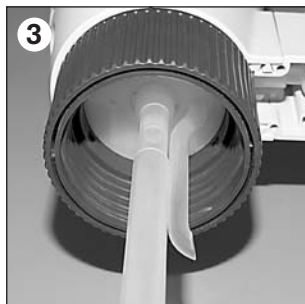
随仪器提供的PP材质接头只能使用不攻击PP材质的试剂（见30页“附件”）。

- 5. 移动滴定器** 当移动安装在瓶口的滴定器时，请按照图示操作（图5）。

警告！

当设置成“滴定模式”时，不要旋动滴定旋钮，确保滴定管盖处于关闭状态时。

避免溅撒试剂！试剂可能从滴定管与管盖之间溢出。



提示：

在使用仪器之前，确保已经经过仔细清洗并使用一些滴定试剂进行润洗。避免溅撒试剂。

1. 确保滴定管盖完全盖上。
2. 将阀门箭头方向指向“回流”（图2）。
3. 首先，将旋钮向下旋到底。然后向上旋转，补液至一半体积位置，然后再次清空（图3）。

提示：

如果无法补液，见32页“故障诊断”。

然后将旋钮上下转动半圈，抽吸液体数次。每次排液快速一次到底将液体清回瓶内。重复此操作5次直到没有可见的大气泡在活塞下面。

提示：

一些小于1 mm的气泡不会影响后面使用。

4. 旋开滴定管盖。
5. 将回流阀调至“滴定”方向（图5）。
6. 取一个合适的容器放在滴定口下方，旋动滴定钮将液体从滴定管中排出，直至滴定管路中没有气泡（图6）。除去滴定头尖部的残液。



滴定

做什么	怎么做	按键	屏幕显示
-----	-----	----	------

1. 打开滴定器电源

按On/Off键打开滴定器电源。



2. 滴定器补液

平滑均匀地向上旋动旋钮，填充液体。按CLEAR键一次将显示数值清零。



3. 滴定

取一个合适的容器放于滴定管开口下方。向下旋动旋钮进行滴定，直至滴定终点。



(滴定体积, 比如, 28.76 ml)

提示： 如果填充试剂不足以完成整个滴定，轻轻向上转动旋钮补充试剂（这个状态下显示数值不变）。然后继续进行滴定。

4. 滴定后补满仪器

滴定完成后请再次补满仪器。

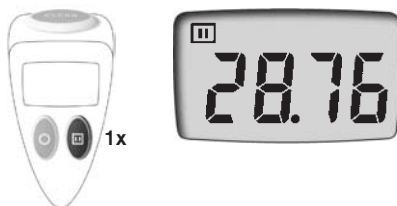
省电模式 (Auto Power Off自动关闭电源)

当停止操作超过3分钟（工厂默认），滴定器会自动切换至待机模式。当时的显示数值会被储存，在再次手工打开显示时数值会重现。自动关闭电源的时间可以调整（参见20页）。

如果由于滴定器没有完全灌满而在滴定过程中产生气泡，可以将液体排至另外一个容器（赶走气泡）而不会改变显示数值。

1. 使用暂停功能

按“Pause”暂停键。
显示暂停符号闪烁。

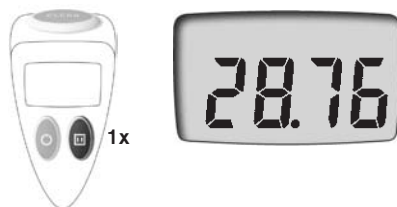


2. 补液或排液，等等。

(参见第9页的描述)。

3. 停止暂停功能

再次按“Pause”暂停键。
暂停符号消失。



4. 继续滴定

计算机接口 (选配)

滴定器有可选的RS 232计算机接口的型号（参见订购信息）。与标准配置相比，拥有以下优点：

- 连接两下清零键，滴定结果可自动传输到电脑中，从而减少原始数据发生错误的几率，并遵循了“GLP”规范的要求。
- 每次数据传输，滴定器会自动输送滴定体积、设备序列号、标称量程、校准体积、以及预约的下次校准日期。这样，所有原始数据被收集传入电脑。

传输数据被识别为键盘输入的数据。这种数据传输格式应用广泛，保证滴定器与任何支持键盘输入的计算机都相兼容。

可通过标准的USB/RS 232转接口将设备与USB接口连接。

提供计算机连接线（9针Sub-D接口）一根，一张CD*（驱动程序及公开的RS 232通讯技术手册）。内含编程将数据整合入数据库所需的所有信息。除此之外，这张CD还包含一个XLS格式的应用实例，一份操作手册与一份测试指南（SOP）。

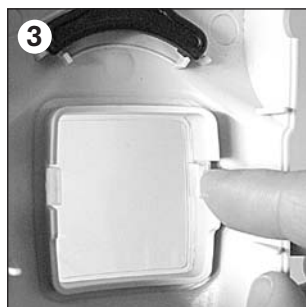
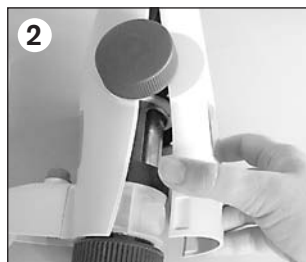
* 德语 / 英语

敏感试剂

更换观察窗

对于光敏感试剂（比如，碘，高锰酸钾或硝酸银溶液），我们建议使用光敏保护观察窗替代原有观察窗。

1. 用手或者一枚硬币旋开旋开后通气盖（图1）。
2. 打开后仓壳（图2）。
3. 轻压观察窗的一侧将其推出（图3）。
4. 将棕色观察窗曲度较小的一片装入后仓壳。
5. 更换前观察窗，抬起观察窗的一角，可用指甲，将其拉出（图5）。
6. 将棕色前观察窗突出的一面向外装入前仓壳。
7. 先对齐外壳顶部，然后轻压将前后仓壳合拢。旋上后通气盖。



安装干燥管（可选）

在使用对湿气，二氧化碳等敏感的试剂时，可能需要使用干燥管（参见62页“附件”）。

1. 旋下后通气盖（参见上面操作）。
2. 在干燥管中装入合适的吸收剂（需另购），然后安装在后通气口。

提示：

如有必要，请使用PTFE密封圈密封干燥管与滴定器以及瓶口或瓶口转接头与滴定器的连接处。



针对本仪器的标称量程（即最大量程）的误差极限，为使用蒸馏水在稳定的环境温度（20 °C）下测得。操作按照DIN EN ISO 8655-6的要求，完全充满仪器并均匀顺滑地进行标称体积或部分体积的排液。



误差极限对照：

量程 ml	部分体积 ml	Titrette® 瓶口滴定器		瓶口滴定器， 参照DIN EN ISO 8655-3 标准				玻璃滴定管，A级， 参照DIN EN ISO 385 标准	
		A* ≤± % μl	CV* ≤ % μl	A* ≤± % μl	CV* ≤ % μl	EL** ± μl			
25	25	0.07 18	0.025 6	0.2 50	0.1 25	30			
	12.5	0.14 18	0.05 6	0.4 50	0.2 25	30			
	2.5	0.70 18	0.25 6	2 50	1 25	30			
50	50	0.06 30	0.02 10	0.2 100	0.1 50	50			
	25	0.12 30	0.04 10	0.4 100	0.2 50	50			
	5	0.60 30	0.20 10	2 100	1 50	50			

* A = 准确度, CV = 偏差系数 ** EL = 误差极限

最大分辨率：

25 ml 滴定器：0.001 ml, 滴定体积超过20 ml则为0.01 ml;

50 ml 滴定器：0.002 ml, 滴定体积超过20 ml则为0.01 ml。

提示：

单个测试的最大误差极限的计算方式： $EL = A + 2 CV$ 。

25 ml量程的最大误差极限为±30 μl，50 ml量程的最大误差极限±50 μl。

这表明本仪器能达到根据DIN EN ISO 385标准规定的A级玻璃滴定管的误差极限范围。

检查体积 (校准)

根据使用情况，我们建议每隔3-12个月对本仪器进行一次重力法测试。测试的时间间隔可根据各自的情况进行调整。完整的测试步骤 (SOP) 可以在www.brand.de下载。此外，也可以在更短的时间间隔内进行简单的检查操作，比如针对一些标准品进行滴定。为了符合GLP或ISO评估与记录，我们建议使用BRAND的EASYCAL™ 校准软件进行校准测试。可在www.brand.de上下载试用版。

根据DIN EN ISO 8655-6进行重力法体积测试 (测试条件，参见45页的“误差极限”) 操作如下：

1. 准备仪器

清洁滴定器 (参见22页“清洁”)，使用蒸馏水进行补液，小心充满滴定器。

2. 检查体积

- 向废液缸排出5滴，擦净滴定管排液头。
- 按“CLEAR”键将显示清零。
- 建议测试3个体积范围 (100%，50%，10%)，每个体积范围测试10个排液量。
- 使用双手不间断地旋转旋钮直到显示达到测试体积。擦净滴定管排液头。
- 在分析天平上称量排出液体。(请参照天平厂家的操作手册。)
- 计算排液体积。引入包含温度因素与空气浮力的校正因子Z。

3. 计算

平均体积

x_i = 称量结果
 n = 称量次数

Z = 校正因子
(比如 1.0029 $\mu\text{l}/\text{mg}$, 20 °C, 1013 hPa)

$$\text{平均值 } \bar{x} = \frac{\sum x_i}{n}$$

$$\text{平均体积 } \bar{V} = \bar{x} \cdot Z$$

准确度*

$$A\% = \frac{\bar{V} - V_0}{V_0} \cdot 100$$

V_0 = 标称体积

标准偏差

$$s = Z \cdot \sqrt{\frac{\sum (x_i - \bar{x})^2}{n - 1}}$$

偏差系数*

$$CV\% = \frac{100 s}{\bar{V}}$$

* 计算准确度 (A %) 与偏差系数 (CV %): A % 与 CV % 根据统计学控制公式计算。

页码

- 1. “CAL”模式**
校准调节 _____ **16**
Easy Calibration 易校准技术可协助无需工具，快速简单的校准调节仪器。
- 2. “GLP”模式**
校准日程 _____ **19**
按照GLP的需要输入校准日程计划
- 3. “APO”模式**
自动关闭电源 _____ **20**
设定仪器在长时间等待之后自动关闭电源。
- 4. “dP”模式**
小数位 _____ **21**
在‘20 ml’内选择显示2位或3位小数位。

为了抵消在相当长一段时间的使用之后或在更换活塞/活塞腔组件之后，可能的最高达0.999 ml的偏差，需要进行校准调节。改变出厂设置后屏幕上部会显示一个小小的“CAL”图标。

做什么	怎么做	按键	屏幕显示
1. 计算调整值	调节值为相对标称体积值的偏离量的平均值（比如，平均体积为50.024 ml，标称体积为50 ml。调整值= 50.024 ml - 50.000 ml = 0.024 ml）。如何计算平均值，参见14页“校准”。		
2. 调出“CAL”模式	当仪器打开时，按住“CLEAR”超过3秒。下列模式会一个接一个地反复显示： CAL - GLP - APO - dP	> 3 s 	
	当“CAL”模式显示在屏幕上，释放“CLEAR”按键。“CAL”会闪烁并且显示数字。		
3. 输入并调整数值	例如，调整值为0.024 ml，按“Pause”键与“on/off”更改数值。		
4. 确认设置	按“CLEAR”键确认输入的数值。 当原厂默认设定被改变，“CAL”图标会一直出现在显示屏上。	1x 	

提示：

如果约15秒之后仍没按“CLEAR”，则会重置起始状态。



持续显示的"CAL"图标说明原厂默认设置已经被改变。
输入新的调整数值，会自动加入已存数值。

做什么	怎么做	按键	屏幕显示
1. 计算调整值	已经调整过的仪器出现了相对于标称量程来说新的平均偏离，例如0.017 ml。如何计算平均值，参见14页"校准"。		
2. 调出"CAL"模式	当仪器打开时，按住"CLEAR"超过3秒。下列模式会一个接一个地反复显示： CAL - GLP - APO - dP	> 3 s 	
	当"CAL"模式显示在屏幕上，释放"CLEAR"按键。"CAL"会闪烁并且显示上次调整的数字。		
3. 输入并调整数值	例如，调整值为0.017 ml，按"Pause"键与"on/off"更改数值。（第一次按键会将显示调为零）。		
4. 确认设置	按"CLEAR"键确认输入的数值。 当原厂默认设定被改变，"CAL"图标会一直出现在显示屏上。	1x 	

提示：

在罕见的情况下，新输入的数值与上次调整的数值总和为零。在这这情况下，默认设置重新生效，"CAL"图标将不再显示。

持续显示的"CAL"图标说明原厂默认设置已经被改变。
如果您希望重置工厂默认设置，请按照以下指导操作。

做什么	怎么做	按键	屏幕显示
1. 调出"CAL"模式	当仪器打开时，按住"CLEAR"超过3秒。下列模式会一个接一个地反复显示： CAL - GLP - APO - dP.	> 3 s 	
	当"CAL"模式显示在屏幕上，释放"CLEAR"按键。"CAL"会闪烁并且显示上次调整的数字。		
2. 重置工厂默认设置	同时按"On/Off"按键与"Pause"键删除"CAL"图标。		

下次校准的日程可以储存在GLP模式下（GLP = Good Laboratory Practice）。

做什么	怎么做	按键	屏幕显示
1. 调出"GLP"模式	当仪器打开时，按住"CLEAR"超过3秒。下列模式会一个接一个地反复显示： CAL - GLP - APO - dP。 当"GLP"模式显示在屏幕上，释放"CLEAR"按键。回车符号会闪烁并且显示"oFF"。	> 3 s 	 
2. 输入下次校准日期	一直按着"Pause"键直到显示期望的日期。按键会逐月向后调整校准日期。按"On/Off"按键缩短校准时间间隔。（下次校准日期可从"oFF"到12/2099）。		
3. 确认设置	按"CLEAR"键确认下次校准日期设置。	1x 	
提示：	储存的校准日期在每次开机时都可以进行提示。只需简单地按住"On/Off"键。"GLP"图标，计划下一次校准的年和月会连续显示。释放按键，此显示会停止，仪器开机。（如果在计划校准日期为"oFF"，则此功能自动关闭。）	> 2 s 	

在"APO"模式下，自动关机的时间设置范围可从1分钟至30分钟。
工厂默认设置自动关机时间为3分钟。自动关机时间设置得越短，则电池的服务时间将会更长。

做什么	怎么做	按键	屏幕显示
1. 调出"APO"模式	当仪器打开时，按住"CLEAR"超过3秒。下列模式会一个接一个地反复显示： CAL - GLP - APO - dP.	> 3 s 	
	当"APO"模式显示在屏幕上，释放"CLEAR"按键。回车符号会闪烁并且显示工厂默认设置。		
2. 输入自动关机的时间	按"Pause"键或者"On/Off"键调整数值（1 - 30分钟）。设置为"oFF"将关闭自动关机功能。		
3. 确认设置	按"CLEAR"键确认关机时间的设置或关闭（"oFF"）自动关机。	1x 	

提示：

当仪器自动关机后再次开机，关机前最后一个显示数值会自动重新显示在屏幕上。当自动关机设置为"oFF"，自动关机功能被关闭，也就不会自行切断电源。

在"dP"模式，显示小数位可设为2位或者3位（工厂默认为2位）。

提示：因为技术原因，滴定数值超过20.00后只会显示2位。

做什么	怎么做	按键	屏幕显示
1. 调出"dP"模式	当仪器打开时，按住"CLEAR"超过3秒。下列模式会一个接一个地反复显示： CAL - GLP - APO - dP.	> 3 s 	
	当"dP"模式显示在屏幕上，释放"CLEAR"按键。回车键会闪烁并且显示工厂默认设置。		
2. 改变小数位设置	按"Pause"键选择显示3位小数位。 (再次按"Pause"可将显示小数位重置为2位。)		
	3. 确认设置	按"CLEAR"键确认设置的显示小数位格式。	1x 

清洁

假设在正确的使用情况下本仪器出现以下状况，说明需要进行仪器清洁

- 如果滴定旋钮变得干涩难以转动，
请立即进行清洁
- 打算拆卸仪器之前
- 变换使用试剂之前
- 当使用易产生结晶的试剂时需要定期进行清洁
- 准备长期储存之前
- 当液体积聚在滴定管的旋盖内时

警告！ 玻璃活塞腔，阀门，伸缩吸液管与滴定管含有试剂！
必需遵循安全指导（参见第4页）！

标准清洁

1. 在打开的滴定管口下方放置一个合适的接收容器。转动手动旋钮彻底清空仪器。
2. 将滴定器拧在一个充满去离子水的试剂瓶上并将回流阀指向“滴定”方向（图2）。
3. 在滴定管口下方放置一个合适的接收容器，通过多次完全补满与排空滴定器操作进行清洗（图3）。
4. 将回流阀指向“回流”方向（图4），通过多次完全补满与排空滴定器操作进行清洗。
5. 如有必要，可以使用合适的清洁剂重复上述步骤。
6. 然后，再次使用去离子水清洗。
7. 将滴定器拧在一个空试剂瓶上。上下多次旋转滴定旋钮清空活塞腔（图7）。
8. 将回流阀指向“滴定”方向，放置一个合适的容器在滴定管下方，排空滴定管。



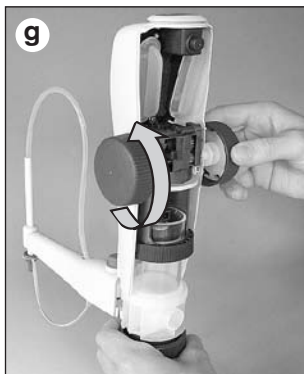
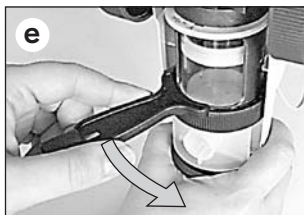
强化清洁

警告！ 分液活塞腔、阀门、伸缩吸液管与滴定管含有试剂！因此，在拆卸本仪器前必须先进行标准清洗操作。必需遵循安全指导（参见第4页）！

为防止搞混组件，不要同时拆卸多个滴定器。
拆卸或更换活塞/活塞腔组件之后必须进行校准及必要的调节。

1. 移去仓壳上部

- a) 拔掉回流管与伸缩吸液管。
- b) 用手或一个硬币旋下后通气盖。
- c) 取下后仓壳并从内取出安装工具。
- d) 将活塞移至顶部。
- e) 使用安装工具旋松活塞/活塞腔组件的安全环，然后用手完全旋开（图e）。
- f) 拉出活塞杆的锁扣（图f）。
- g) 旋转滴定旋钮将仪器上半部分推出，移开（图g + g'）。



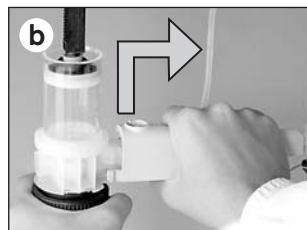
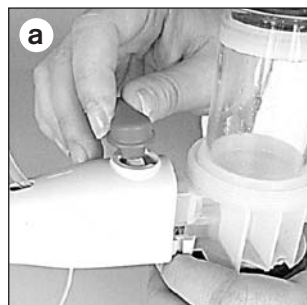
提示： 结晶溶液，比如，氢氧化钾乙醇溶液

滴定完毕之后总是重新将仪器补满液体。根据使用频率，我们建议活塞上的结晶沉淀应该约每8周定期清理。

1. 使用旋钮将活塞移至顶部再向下旋转旋钮半圈。
2. 移去上部仓壳。
3. 使用水与软刷去除分液活塞腔边缘的结晶沉淀。
4. 然后使用纤维素干燥剂干燥。
5. 如有必要，进行进一步拆卸。

2. 移去与清洁/更换滴定管

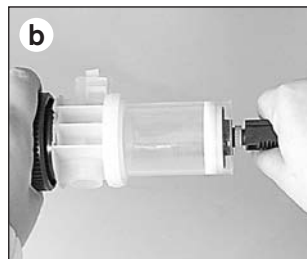
- a) 将回流阀指向“回流”方向然后向上拔出阀门控制杆（图a）。
- b) 如图示握住滴定管。将滴定管向上抬至一个停顿点，然后轻轻地上下运动，拉出滴定管（图b）。
- c) 滴定管与整合其上的排液阀应该进行超声波清洗，或者更换。



3. 清洗或更换活塞/活塞腔组件

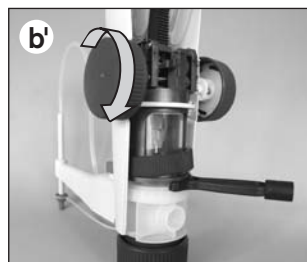
活塞/活塞腔组件由活塞与一个含阀门模块的分液腔构成。如果液体溢出活塞，则需要更换活塞。我们建议将整个活塞/活塞腔组件一起更换。

- a) 使用水与软刷清除玻璃活塞腔上部边缘可能存在的结晶沉淀。
- b) 握住活塞杆慢慢将活塞拉出活塞腔（图b）。



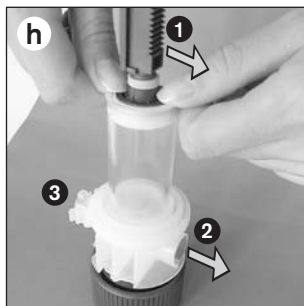
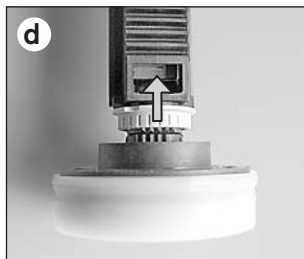
提示：

如果活塞难以移动，使用仪器的上半部分，将安装工具置于活塞柱与上半部（安全环）之间（齿向上），转动旋钮，这样可将活塞完全推出活塞腔（图b'）。



- c) 使用软布清洁活塞腔与活塞，或者更换它们。
- d) 要更换活塞，先将灰色安全环向上拨（图d），然后旋下活塞头（图d'）。
- e) 拧上一个新的活塞，确保其安全紧固。
- f) 对齐活塞与活塞杆上的齿轮，活塞可以向后旋转最多半个齿来进行对齐（图d）。
- g) 将灰色安全环拨下。
- h) 将活塞杆的锯齿条（1）对齐阀门模块的后通气口。在滴定管连接处的另一面（3）。小心地垂直插入清洁完或新更换的活塞并按到一半高度（图h）。

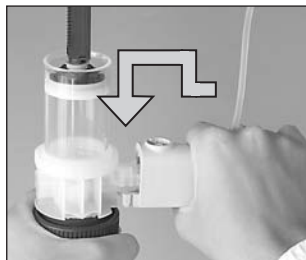
提示： 切勿损伤活塞的唇封。应避免与坚硬物体接触！



4. 安装滴定管

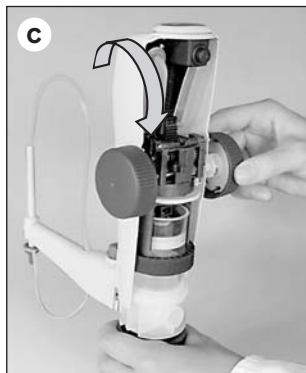
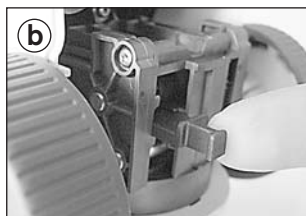
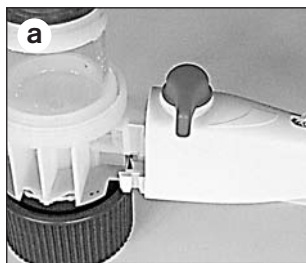
安装清洁后或替换的滴定管

- 1.) 插入滴定管5 mm左右。
- 2.) 抓住滴定管外壳使其向上滑到底。
- 3.) 将滴定管完全插入。
- 4.) 将滴定管外壳向下滑动扣紧。



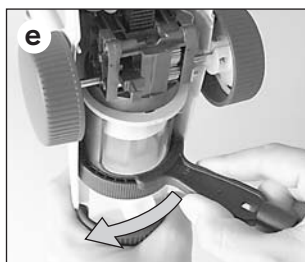
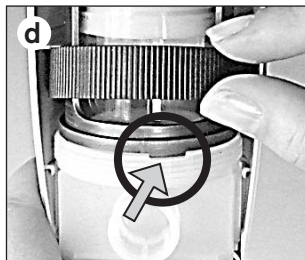
5. 安装上部仓壳

- a) 将回流阀阀门杆拨至“回流”位置，然后将阀门杆按下加紧（图a）。
- b) 检查锁扣的位置为拉出状态（图b）。
- c) 装上滴定器上半部分，旋转旋钮将其套入，注意前仓壳的缺口应紧贴滴定管嵌入。如有必要，稍稍旋转滴定仪上半部分（图c）。



（下页继续！）

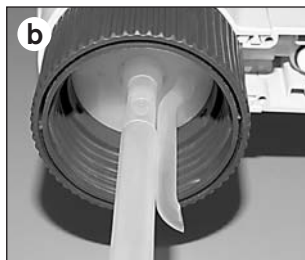
- d) 抬起活塞/活塞腔组件的安全环，检查上半部的突起与阀门模块的缺口是否合拢。然后，用手拧紧安全环（图d）。
- e) 将安装工具放在安全环右部边缘然后向左手方向旋转，紧固安全环（图e）。
将安装工具放回后仓壳存放。
- f) 推入活塞杆锁扣。
- g) 首先将前后仓顶部扣住，然后阖上前后仓壳。旋上后通气盖。
- h) 执行功能检查与校准，进行适当的调整。



6. 清洁/更换进液阀

在拆卸本仪器前必须先进行标准清洗操作！

- a) 打开后仓壳取出安装工具。
- b) 拔下伸缩吸液管与回流管（图b）。
- c) 使用安装工具旋下进液阀（图c）。
- d) 如果密封圈已经污染或者损坏，小心地使用弯头镊子取出密封圈（图d）。
- e) 超声波清洗进液阀与密封圈（图e）。
- f) 插入经清洁或新的密封圈（参考图e）。
- g) 先用手拧上进液阀（图g），然后使用安装工具将其拧紧（多拧1/4圈已经足够）。



提示：

当活塞向上旋时仪器无法补液，但有弹性阻力存在，说明很可能球阀堵塞。

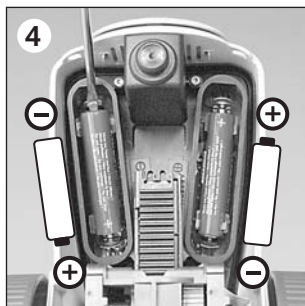
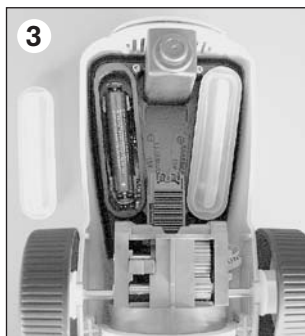
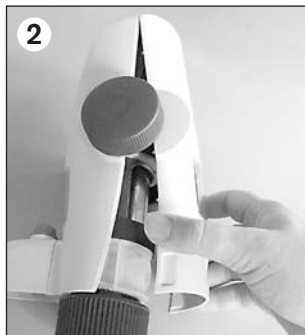
这时，想办法推松球阀，比如，用200 μ l塑料移液器吸头顶一下（参见右图）。



更换电池

显示屏上电池图标闪烁代表电池已经耗尽。应该更换电池。
请使用指定规格电池：1.5 V (AAA/UM4/LR03)。电池不可充电。

1. 用手或一枚硬币旋下后通气盖（图1）。
2. 移去后仓壳（图2）。
3. 移去电池仓盖（图3）。
4. 使用起子取出电池（图4）。
5. 插入新的电池然后将它们按实。
注意正确的电池极性（图4）。
6. 关闭电池仓盖。仔细压紧电池仓盖的边缘。
7. 首先将前后仓顶部扣住，然后阖上前后仓壳。旋上后通气盖。



警告！

根据适用法规，电池必需充分放电之后才能丢弃。不要短接电池两极进行放电——这样会有爆炸的风险！



Titrette® 数字瓶口滴定器

标准配置

附RS 232计算机接口

量程	货号	货号
25 ml	4760 151	4760 251
50 ml	4760 161	4760 261

瓶口转接头，PP材质。1个/包。



外螺纹	适配瓶口螺纹/规格	货号
GL 32	GL 28	7043 28
GL 32	GL 30	7043 30
GL 45	GL 32	7043 96
GL 45	GL 38	7043 97
GL 45	S* 40	7043 43
GL 32	NS 24/29	7044 24
GL 32	NS 29/32	7044 29

* 锯齿螺纹

滴定管

附旋盖和整合的排液阀及回流阀。1个/包。

货号 7075 26



进液阀带橄榄形管嘴及密封垫圈。1个/包。

货号 6636



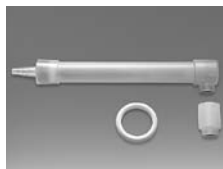
旋盖带固定条。
1个/包。

货号 7075 28

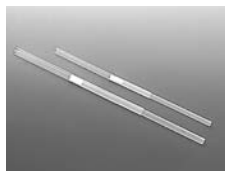


干燥管干燥管及密封圈，不含干燥剂。
1个/包。

货号 7079 30



伸缩式吸液管，FEP材质。1个/包。



回流管，1个/包。



货号 8317

长度	货号
170 - 330 mm	7042 04
250 - 480 mm	7042 05

活塞，1个/包。



排液活塞腔，带阀门模块



用于体积	货号
25 ml	7075 30
50 ml	7075 32

用于体积	货号
25 ml	7075 34
50 ml	7075 36

观察窗，1套无色观察窗及1套棕色观察窗（光敏保护）。



通气盖，1个/包。



货号 6783

货号 6659

安装工具，1个/包。



微电池，1.5 V 不可重复充电（AAA/UM4/LR03）。2个/包。



货号 6784

货号 7260

针对带PC接口的型号

RS 232连接线
长度2 m
1个/包。



Titrette® 软件CD-ROM
德文/英文
1个/包。



货号 8850

货号 7075 38

故障诊断

问题	可能的原因	应对方法
液体溢出活塞	活塞磨损	清洁，更换活塞/活塞腔组件（参见24页）。
活塞移动困难	活塞/活塞腔组件被污染或由于结晶沉淀损坏	立即停止滴定，进行清洁；如有必要更换活塞/活塞腔组件（参见24页）。
无法补液	进液阀堵塞	清洁进液阀。如有堵塞可用200 μ l塑料移液器吸头顶松阀门球（参见28页）。
无法补液/补液时液体从滴定管倒吸	排液阀污染或滴定管损坏	清洁排液阀或更换滴定管（参见24页）。
仪器内有气泡	补液操作过于激烈	请慢慢补液。
	吸液管松了或者损坏	上紧吸液管。如有必要，从顶部剪去约1 cm再插入。
	进液阀松了或可能没有放入密封圈	检查是否装入密封圈，使用安装工具上紧进液阀。
	吸液管未浸入液体	试剂瓶加液，或者调整伸缩吸管的长度。
	未装回流管或者回流管安装不正确	安装回流管。开口应该朝向试剂瓶瓶壁。
无法滴定	排液阀堵塞	清洁或更换滴定管及排液阀（参见24页）。
排液体积小于显示体积	仪器没有完全补液补满	再次补液（参见第9页）。
	可能没有使用密封圈或进液阀松了	检查是否装入密封圈，使用安装工具上紧进液阀。
	进液阀堵塞或者损坏	清洁，如有必要更换进液阀（参见28页）。
仪器不显示任何功能	内部错误	执行重启：移去电池，等待1分钟然后更换它们（参见29页）。

如果按照“故障诊断”指导，或通过更换配件仍无法排除故障，则仪器必需送修。

由于安全原因，送修仪器必须事先清洁与去除污染！

仪器送修

- a) 请仔细清洗仪器并去除污染。
- b) 填写“无健康危害申明”（向您的供应商或生产商索要此表格。此表格可在www.brand.de下载）。
- c) 将申明表与仪器一同寄给经销商或生产商，准确描述故障情况与所使用的试剂。

相应的运输费用与风险由发送者承担。

校准服务

ISO 9001与GLP要求定期检查体积计量仪器。我们建议每隔3-12个月进行检查。时间间隔由使用的要求决定。如经常使用具有侵蚀性的试剂，间隔应该短一些。具体的测试指南可在www.brand.de下载。BRAND同样提供工厂校准服务与经授权的DKD校准服务。

只需寄回需要校准的仪器与需要哪种校准服务的申请。您可在数日内重新获得经过校准的仪器与相应的厂方校准证书或者是DKD/DAkkS*校准证书。需要了解更多信息，请联系您的经销商或者BRAND。完整的订购信息可在www.brand.de下载（参见Technical Documentation）。

* 基于法律要求，自2010年1月1日，DKD授权已经转变为DAkkS授权（Deutsche Akkreditierungsstelle GmbH）。

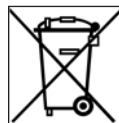
责任担保

我们不能承担由于不当拿取，使用，服务，操作或未授权的仪器维修产生的结果，我们同样不能承担由于正常易损件如活塞，密封垫圈，阀门的磨损或者玻璃破损而产生的结果，我们也不能承担由于不按照操作手册指导的操作而产生的结果。我们不能承担由于进行任何操作手册未描述的操作与使用或者由于非原装配件的使用而产生的结果。

丢弃

此处的标志说明储存的电池与电子设备在超出寿命之后不可以丢弃于生活用的垃圾箱（混合有生活垃圾）。

- 根据欧洲废弃电力或电子设备委员会（WEEE）于2003年1月27日的2002/96/EC指令，电子设备应该根据对应国家的法律进行处置。
- 电池包含可能对于环境与人体有害的物质。因此根据欧洲废弃电池委员会于2006年9月6日生效的2006/66/EC指令废旧电池应该根据对应国家的法律进行处置。废旧电池只有在完全放电后才能丢弃。



警告！ 不要短接电池两极进行放电！

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Safety Instructions

This instrument may sometimes be used with hazardous materials, operations, and equipment. It is beyond the scope of this manual to address all of the potential safety risks associated with its use in such applications. It is the responsibility of the user of this instrument to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

Please read the following carefully!

1. Every user must read and understand this operating manual before operation.
2. Follow general instructions for hazard prevention and safety instructions; e.g., wear protective clothing, eye protection and gloves.
3. Observe the reagent manufacturers' information.
4. Never use the instrument in an atmosphere with danger of explosion.
5. Use the instrument only for titrating liquids, with strict regard to the defined limitations of use and operating limitations. Observe operating exclusions (see page 37)! If in doubt, contact the manufacturer or supplier.
6. Always use the instrument in such a way that neither the user nor any other person is endangered. Avoid splashes. Use only suitable containers.
7. Never turn handwheels when the closure cap is screwed on.
8. Never remove the titrating tube while the glass cylinder is filled.
9. Reagents can accumulate in the closure cap of the titration tube. Thus, it should be cleaned regularly.
10. For small bottles use a bottle stand to prevent tipping over.
11. An instrument mounted on a reagent bottle should never be carried by the housing. Breakage or separation of the instrument from the reagent bottle can lead to injury.
12. Never use force on the instrument.
13. Use only original manufacturer's accessories and spare parts. Do not attempt to make any technical alterations. Do not dismantle the instrument any further than is described in the operating manual!
14. Before use check the instrument for visual damage. If there is a sign of a potential malfunction during operation (e.g., piston difficult to move, sticking valves or leakage), immediately stop titrating. Consult the 'Troubleshooting' section of this manual (see page 64), and contact the manufacturer if needed.
15. The included 1.5 V micro-batteries are not rechargeable!

Functions and Limitations of Use

The bottle-top burette Titrette® with an electronic digital display is used for the titration of aqueous and non-aqueous titration media (e.g., alcoholic KOH) up to a max. concentration of 1 mol/l (see page 37 for recommended application range). It comes with a certificate of conformity according to the metrological requirements of DIN EN ISO 8655-3. Even tight Class A tolerances for glass burettes can be achieved by using a high-precision measuring system.

When the instrument is properly handled, dispensed liquid will only come into contact with the following chemically resistant materials: borosilicate glass, Al₂O₃, ETFE, PFA, FEP, PTFE, platinum-iridium; PP (screw cap). The instrument possesses a recirculation valve as the factory default.



CE Marking

This sign certifies that the product meets the requirements of the EC directive and has been tested according the specified test methods.

Limitations of Use

This instrument is designed for titrating liquids, observing the following physical limits:

- +15 °C to +40 °C (59 °F to 104 °F) of instrument and reagent
- vapor pressure up to 500 mbar
- viscosity up to 500 mm²/s
- altitude: max. 3000 m above sea-level
- relative air humidity: 20% to 90%

Operating Exclusions

Never use this instrument for

- liquids attacking borosilicate glass, Al₂O₃, ETFE, PFA, FEP, PTFE or platinum-iridium (e.g., hydrofluoric acid)
- suspensions (e.g., of charcoal) as solid particles may clog or damage the instrument
- concentrated acids and bases as well as non-polar solvents which effect swelling of plastics (e.g., Toluene, Benzene)
- Carbon disulfide, as this media is highly flammable
- The instrument must not be autoclaved!

Operating Limitations

Chlorinated and fluorinated hydrocarbons or chemical combinations which form deposits may make the piston difficult to move or may cause jamming.

When working with crystallizing solutions follow cleaning instructions (see pages 54 - 57).

Compatibility of the instrument for this special application (e.g., trace material analysis) must be checked by the user or contact the manufacturer.

Battery Specifications

2 micro-batteries, 1.5 V (AAA/UM4/LR03), non-rechargeable.

Storage Conditions

Store the instrument and accessories only in cleaned condition in a dry place.

Storage temperature: -20 °C to +50 °C (-4 °F to 122 °F),
relative air humidity: 5% to 95%.

Recommended Application Range

The instrument can be used for the following titration media (max. conc. 1 mol/l):

Reagent

Acetic acid	Iron (II) sulfate solution	Silver nitrate solution*
Alcoholic potassium hydroxide solution	Nitric acid	Sodium arsenite solution
Ammonium iron (II) sulfate solution	Oxalic acid solution	Sodium carbonate solution
Ammonium thiocyanate solution	Perchloric acid	Sodium chloride solution
Barium chloride solution	Perchloric acid in glacial acetic acid	Sodium hydroxide solution
Bromide bromate solution	Potassium bromate solution	Sodium nitrite solution
Cerium (IV) sulfate solution	Potassium bromate bromide solution	Sodium thiosulfate solution
EDTA solution	Potassium dichromate solution	Sulfuric acid
Hydrochloric acid	Potassium hydroxide solution	Tetra-n-butylammonium hydroxide solution
Hydrochloric acid in Acetone	Potassium iodate solution	
Iodine solution*	Potassium permanganate solution*	Triethanolamine in Acetone*
Iodide Iodate solution*	Potassium thiocyanate solution	Zinc sulfate solution

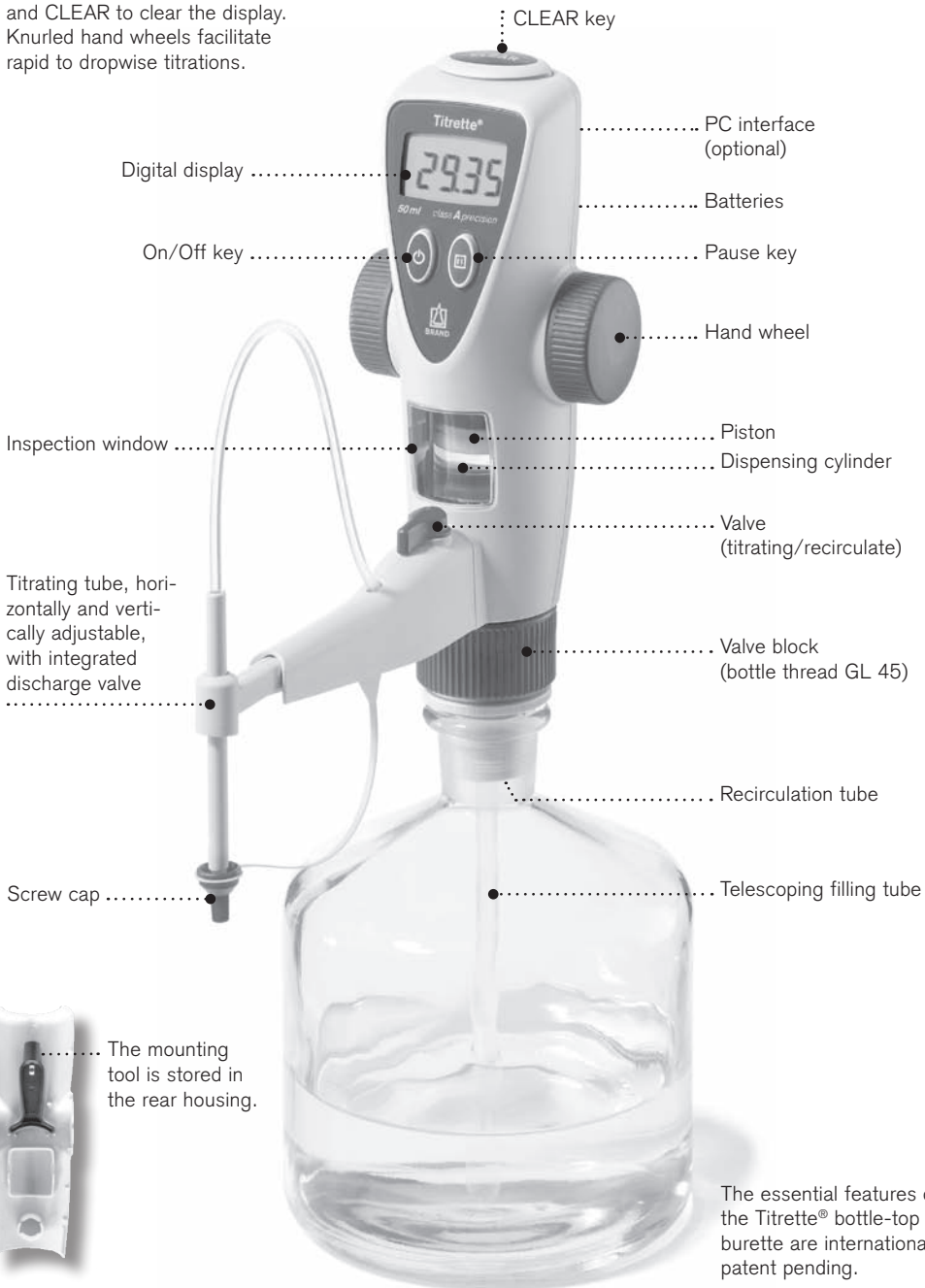
* Use light shield inspection windows (see page 44).

The above recommendations reflect testing completed prior to publication (Status as of 0411/4). Always follow instructions in the operating manual of the instrument as well as the reagent manufacturer's specifications. Should you require information on chemicals not listed, please feel free to contact BRAND.

Operating Elements

Controls:

Separate keys for On/Off, Pause and CLEAR to clear the display. Knurled hand wheels facilitate rapid to dropwise titrations.



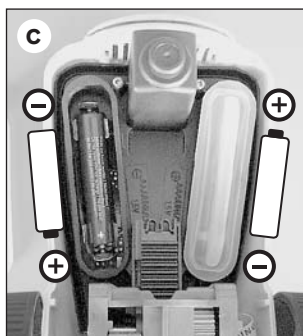
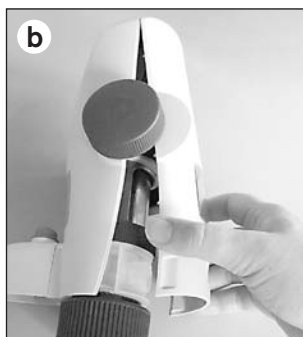
Is everything in the package?

Confirm that your package includes: Titrette® bottle-top burette, size 25 ml or 50 ml; telescoping filling tube (length 170 - 330 mm); recirculation tube; 2 micro-batteries 1.5 V (AAA/UM4/LR03); 3 bottle adapters PP (GL 45/32, GL 45/S 40, GL 32/NS 29/32); 2 colored light shield inspection windows; performance certificate; and this operating manual.

Initializing

1. Insert batteries

- Unscrew the air vent cap by hand or use a coin (Fig. a).
- Remove the rear housing (Fig. b).
- Remove the battery case cover and insert the batteries. Observe the correct polarity of the batteries (Fig. c).
- Close the covers of the battery case tightly. Carefully press the edges so that the entire cover rests firmly and leaves no gap to the battery case.
- First connect the housing at the top, then snap it closed.
- Screw in the air vent cap.



2. Switching the instrument ON or OFF

Press the On/Off key briefly to switch the instrument on or off.



Initializing (cont.)

Attention:

Wear protective clothing, eye protection and gloves! Follow all safety instructions and observe limitations of use and operating limitations (see page 37).

3. Mounting the filling tube and recirculation tube

Adjust the length of the telescoping filling tube to the bottle height and attach it. Insert the recirculation tube with the opening pointing outward (Fig. 3).

Note:

With readily crystallizing media, e.g. alcoholic KOH, the length of the telescoping filling tube should be adjusted to a distance of approx. 20 mm from the bottom of the bottle.

4. Mounting and aligning the instrument on a bottle

Screw the instrument (GL 45 thread) onto the reagent bottle and then align the titrating tube with the bottle label. For bottles with other thread sizes, select a suitable adapter. The titrating tube can be adjusted by 70 mm both horizontally and vertically (Fig. 4).

Note:

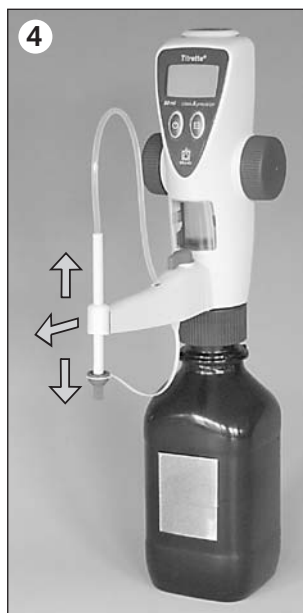
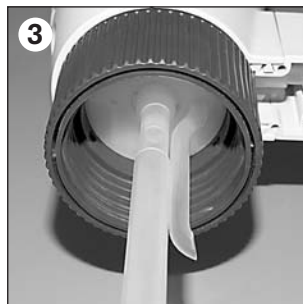
The adapters supplied with the instrument are made of polypropylene (PP), and can only be used for media which do not attack PP (see 'Accessories', page 62).

5. Transporting the instrument

When mounted to a reagent bottle, always carry the instrument as shown in the figure (Fig. 5)!

Warning!

Do not rotate the hand wheels when the valve is set to 'Titrate' and the titrating tube is closed with the screw cap. Avoid splashing the reagent! The reagent can drip out from the titrating tube and screw cap.



Note:

Before using the instrument for the first time, ensure it is rinsed carefully and discard the first few samples dispensed. Avoid splashes.

1. Ensure that the screw cap for the titrating tube is screwed on firmly.
2. Turn the valve in the direction of the arrow to 'Recirculate' (Fig. 2).
3. First, turn the hand wheel to move the piston all the way down. For filling the piston, turn it at most half-way up, and then empty it again (Fig. 3).

Note:

If filling is not possible, see 'Troubleshooting' on page 64.

Then use a half rotation of the hand wheel to take up liquid several times, each time using a single stroke to the lower position to empty it into the bottle. Repeat this procedure 5 times until no more large bubbles are seen below the piston.






Note:

A few bubbles up to 1 mm in size are permissible.

4. Unscrew the screw cap from the titrating tube.
5. Turn the valve to 'Titrate' (Fig. 5).
6. Hold a suitable receiving vessel under the opening and dispense liquid to prime the titrating tube until it is bubble-free (Fig. 6). Wipe away any remaining drops from the titrating tube tip.



Titrating

What to do	How to do it	Keys to press	Display readout
1. Powering on the instrument	To power on the instrument, press the On/Off key.		
2. Filling the instrument	Fill the instrument smoothly up to the upper position by turning the hand wheels. Press the CLEAR key once briefly in order to set the display value to zero.		
3. Titrating	Hold a suitable receiving vessel under the opening of the titrating tube. By turning the hand wheels, deliver liquid up to the titration end point.		 (titrated volume, e.g., 28.76 ml)
Note:	If the fill volume is insufficient for the entire titration, refill by gently turning back the hand wheels to the upper position (the displayed value remains unchanged during this process). Then continue with the titration.		
4. Fill the instrument after titration	After titration always fill the instrument up to the upper position again.		

Energy-saver mode (Auto Power Off)

When work is interrupted for more than three minutes (factory default setting), the instrument automatically switches to Standby Mode. The display value is stored at this point, and appears again in the display after switching back on manually. The time period before automatic switch to Standby can be adjusted (see page 52).

If air bubbles appear during titration because the instrument has not been completely primed, liquid can be dispensed into a different receptacle for priming without the display value being changed.

1. Start the Pause function

Press the Pause key.
The Pause signal blinks.



2. Prime the instrument, dispense liquid, etc.

(See page 41 for description).

3. End the Pause function

Press the Pause key again.
The Pause signal then disappears.



4. Continue the titration

PC interface (optional)

The instrument is available with an optional RS 232 communications interface (see ordering information). The version with the interface offers the following advantages over the standard configuration:

- The titration results are automatically transmitted to the PC by double-clicking on the CLEAR key. This eliminates transcription errors while recording primary data, and complies with an important requirement of GLP.
- With each data transfer, the burette sends the titrated volume, the serial number of the instrument, the nominal volume and the adjustment value, as well as the next scheduled calibration date. Thus, all raw data is collected.

The transmitted data is recognized as keyboard inputs by the PC. This universal input format ensures that the instrument is compatible with all PC applications that accept keyboard inputs.

To connect the instrument to a USB interface, simply use a standard USB/RS 232 adapter.

Items supplied include a connection cable (9-pole Sub-D connector assembly) and a CD* (driver software and a public RS 232 communication protocol). All information required for integration into an existing database is available to programmers. In addition, the CD also contains a sample application in XLS format as well as an instruction manual and the testing procedure.

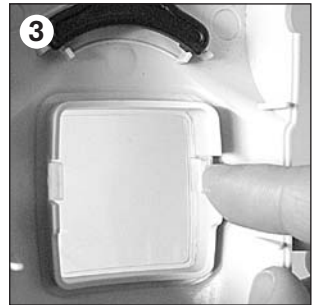
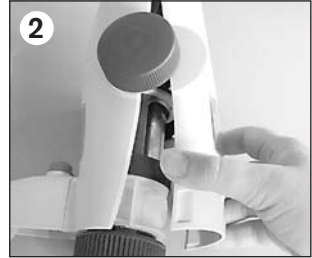
* German / English

Sensitive Media

Replacing the inspection window

For light-sensitive media (e.g., iodine, potassium permanganate and silver nitrate solutions), we recommend the use of the colored light shield inspection window.

1. Unscrew the air vent cap by hand or use a coin (Fig. 1).
2. Remove the rear housing (Fig. 2).
3. Unclip the rear inspection window on one side and push it out (Fig. 3).
4. Place the colored inspection window with the smaller curvature into the rear housing.
5. To change the front inspection window, lift up one corner of the window, e.g., with a fingernail, and pull it out (Fig. 5).
6. Place the colored inspection window with the larger curvature in the front casing.
7. First connect the housing at the top, then snap it closed. Screw in the air vent cap to secure the back housing.



Installing a drying tube (optional)

Use of a drying tube might be necessary for moisture- and CO₂- sensitive media (see 'Accessories', page 62).

1. Unscrew the air vent cap (see above).
2. Fill the drying tube with a suitable absorbent (purchased separately), and mount this in place of the air vent cap.

Note:

If necessary, seal the threads of the drying tube, the bottle and/or the thread adapter with PTFE tape.



Error limits related to the nominal capacity (= maximum volume) indicated on the instrument, obtained when instrument and distilled water are equilibrated at ambient temperature (20 °C/68 °F). Testing takes place according DIN EN ISO 8655-6 with a completely filled instrument and with uniform and smooth dispensing up to the nominal or partial volume.



Comparison of error limits:

Volume ml	Partial volume ml	Titrette® bottle-top burette				Requirements for piston burettes according to DIN EN ISO 8655-3				Glass burette Class A acc. to DIN EN ISO 385
		A* ≤± % μl		CV* ≤ % μl		A* ≤± % μl		CV* ≤ % μl		EL** ± μl
25	25	0.07	18	0.025	6	0.2	50	0.1	25	30
	12.5	0.14	18	0.05	6	0.4	50	0.2	25	30
	2.5	0.70	18	0.25	6	2	50	1	25	30
50	50	0.06	30	0.02	10	0.2	100	0.1	50	50
	25	0.12	30	0.04	10	0.4	100	0.2	50	50
	5	0.60	30	0.20	10	2	100	1	50	50

* A = Accuracy, CV = Coefficient of Variation ** EL = Error limits

The maximum resolution of the display

in the 25 ml instrument: 0.001 ml, and above a 20 ml titration volume is 0.01 ml;

in the 50 ml instrument: 0.002 ml, and above a 20 ml titration volume is 0.01 ml.

Note:

The maximum error limit for a single measurement can be calculated $EL = A + 2 CV$.

The maximum EL for 25 ml size is $\pm 30 \mu\text{l}$ and for 50 ml size $\pm 50 \mu\text{l}$.

This proves that the error limits for Class A burettes per DIN EN ISO 385 are met.

Checking the Volume (Calibration)

Depending on use, we recommend that gravimetric testing of the instrument be carried out every 3-12 months. This time frame should be adjusted to correspond with individual requirements. The complete testing procedure (SOP) can be downloaded at www.brand.de. In addition, a simple inspection can also be carried out over shorter time spans, for example by titration against a standard. For GLP- and ISO-compliant evaluations and documentation, we recommend the EASYCAL™ calibration software from BRAND. A demo version can be downloaded from www.brand.de.

Gravimetric volume testing according to DIN EN ISO 8655-6 (for measurement conditions, see 'Error Limits', page 45) is performed as follows:

1. Preparation of the instrument

Clean the burette (see 'Cleaning', page 54), fill it with distilled H₂O and then prime it carefully.

2. Check the volume

- Dispense 5 drops into a separate receptacle and wipe off the titrating tube tip.
- Press the CLEAR key to set the display value to 'zero'.
- 10 dispensed amounts in 3 volume ranges (100%, 50%, 10%) are recommended.
- Turn the hand wheels with both hands without stopping until the test volume is shown in the display. Wipe off the titrating tube tip.
- Weigh the dispensed amount on an analytical balance. (Please follow the operating manual from the balance manufacturer.)
- Calculate the dispensed volume. The Z factor takes account of the temperature and air buoyancy.

3. Calculation

Mean volume

x_i = Weighing results
 n = Number of weighings

Z = Correction factor
(for example 1.0029 µl/mg at 20 °C, 1013 hPa)

$$\text{Mean value } \bar{x} = \frac{\sum x_i}{n}$$

$$\text{Mean volume } \bar{V} = \bar{x} \cdot Z$$

Accuracy*

$$A\% = \frac{\bar{V} - V_0}{V_0} \cdot 100$$

V_0 = Nominal volume

Standard Deviation

$$s = Z \cdot \sqrt{\frac{\sum (x_i - \bar{x})^2}{n - 1}}$$









Coefficient of Variation*

$$CV\% = \frac{100 s}{\bar{V}}$$

* Calculation of accuracy (A %) and coefficient of variation (CV %):
A % and CV % are calculated according to the formulas for statistical control.

- | | Page |
|---|-----------|
| 1. CAL Mode
<i>Adjustment</i> _____ | 48 |
| <p>The Easy Calibration technique makes rapid and simple instrument adjustments possible without tools.</p> | |
| 2. GLP Mode
<i>Calibration Schedule</i> _____ | 51 |
| <p>Input the scheduled date for calibration designated by GLP.</p> | |
| 3. APO Mode
<i>Auto Power Off</i> _____ | 52 |
| <p>Set up the automatic shut-down for long periods when the instrument is not in use.</p> | |
| 4. dP Mode
<i>Decimal Place</i> _____ | 53 |
| <p>Select the display with 2 or 3 decimal places up to 20 ml.</p> | |

An adjustment might be necessary after a long period of usage or following the replacement of the piston/cylinder assembly, in order to balance out differences in accuracy up to a maximum of ± 0.999 ml. A change from the factory default setting is indicated by the small 'CAL' icon at the top of the display.

What to do	How to do it	Keys to press	Display readout
1. Computing the adjustment value	The adjustment value is the deviation of the mean volume from the nominal volume (e.g., mean volume 50.024 ml, nominal volume 50 ml. Adjustment value = 50.024 ml - 50.000 ml = 0.024 ml). (For calculating the mean volume, see 'Calibration', page 46).		
2. Bring up the CAL mode	With the instrument powered on, press and hold the CLEAR key for more than 3 seconds. The following modes will be repeatedly shown in the display after one another: CAL - GLP - APO - dP When CAL appears in the display, release the CLEAR key. CAL blinks and the digits are displayed.	>3 s 	  
3. Entering an adjustment value	For example, with an adjustment value of 0.024 ml, press the Pause or On/Off keys until the value has been reached.		
4. Confirming setting	Press the CLEAR key to confirm the input of the adjustment value. A change in the factory default setting will be shown by the CAL symbol now continuously being shown in the display.	1x 	

Note:

If the CLEAR key has not been pressed within approx. 15 seconds, the initial status will be retained.







The continuously displayed CAL symbol indicates that the factory default setting has been changed. By entering a new adjustment value, this will be added automatically to the already existing adjustment value.

What to do	How to do it	Keys to press	Display readout
1. Computing the adjustment value	The already adjusted instrument shows a new deviation of the mean volume from the nominal volume, for example, 0.017 ml. (For calculating the mean volume, see page 46).		
2. Bring up the CAL mode	With the instrument powered on, press and hold the CLEAR key for more than 3 seconds. The following modes will be repeatedly shown in the display after one another: CAL - GLP - APO - dP When CAL appears in the display, release the CLEAR key. CAL blinks and the adjustment value for the previously accepted adjustment appears.	> 3 s	
3. Entering an adjustment value	For example, with an adjustment value of 0.017 ml, press the Pause or On/Off keys until the value has been reached (the first keypress will set the display to zero).	- +	
4. Confirming setting	Press the CLEAR key. The old and new adjustment values will be added automatically. A change in the adjustment will be indicated by the CAL symbol.	1x	











Note:

In rare cases, the sum of the new and the former adjustment can account to zero. In this case, the factory default setting is obtained again and CAL disappears from the display.









The continuously displayed CAL symbol indicates that the factory default setting has been changed. If you wish to restore the factory default setting, complete the following instructions.

What to do	How to do it	Keys to press	Display readout
1. Bring up the CAL mode	<p>With the instrument powered on, press and hold the CLEAR key for more than 3 seconds. The following modes will be repeatedly shown in the display after one another: CAL - GLP - APO - dP.</p> <p>When CAL appears in the display, release the CLEAR key. The input symbol blinks and the adjustment value for the previously accepted adjustment appears.</p>	<p>> 3 s</p>  	 
2. Restoring the factory default setting	<p>Press the On/Off key and Pause key at the same time in order to delete the CAL symbol.</p>		

The schedule for the next calibration can be stored in GLP Mode (GLP = Good Laboratory Practice).

What to do	How to do it	Keys to press	Display readout
1. Bring up the GLP mode	With the instrument powered on, press and hold the CLEAR key for more than 3 seconds. The following modes will be repeatedly shown in the display after one another: CAL - GLP - APO - dP.	> 3 s 	
	When GLP appears in the display, release the CLEAR key. The input symbol blinks and 'oFF' appears.		
2. Entering the scheduled date for calibration	Press and hold the Pause key until the desired date is displayed. Pressing briefly extends the scheduled period stepwise. Pressing the On/Off key shortens the scheduled period. (Schedule input can be from 'oFF' to 12/2099)		
3. Confirming setting	Press the CLEAR key in order to confirm the input of the scheduled date for calibration.	1x 	
Note:	The stored scheduled date for calibration can be called up any time the instrument is powered on. To do this, simply press and hold the On/Off key. This brings up a continuous display of GLP, and the year and month of the desired scheduled date. Releasing the key ends the display, and the instrument will be powered on. (If 'oFF' is selected as the scheduled date for calibration, this deactivates the function.)	> 2 s 	

In APO mode, the time for automatic power off can be set from 1 to 30 minutes. In factory default setting the instrument will power down automatically after 3 minutes. The shorter the Auto Power Off setting, the longer battery service life will be.

What to do	How to do it	Keys to press	Display readout
<p>1. Bring up the APO mode</p>	<p>With the instrument powered on, press and hold the CLEAR key for more than 3 seconds. The following modes will be repeatedly shown in the display after one another: CAL - GLP - APO - dP.</p> <p>When APO appears in the display, release the CLEAR key. The input symbol blinks, and the factory default setting is displayed.</p>	<p>> 3 s</p>  	 
<p>2. Entering the time for automatic power off</p>	<p>Press the Pause or On/Off key until the desired time input value (1 - 30 min) is reached. The 'oFF' setting deactivates the automatic power off function.</p>		
<p>3. Confirming setting</p>	<p>Press the CLEAR key in order to confirm the desired power off time or to confirm 'oFF'.</p>	<p>1x</p> 	

Note:

When the instrument powers itself off, the last displayed value will be displayed again when the instrument is powered on. If the input value 'oFF' is confirmed, the function will be deactivated and the instrument will no longer power itself off.

In dP mode, the display can be selectively set to show 2 or 3 decimal places (factory default setting is 2).
Note: For technical reasons, titration volumes above 20.00 ml can only be displayed to 2 decimal places.

What to do	How to do it	Keys to press	Display readout
1. Bring up the dP mode	With the instrument powered on, press and hold the CLEAR key for more than 3 seconds. The following modes will be repeatedly shown in the display after one another: CAL - GLP - APO - dP.	> 3 s	
	When dP appears in the display, release the CLEAR key. The input symbol blinks, and the factory default setting is displayed.		
2. Changing the decimal place setting	Press the Pause key in order to select a display with 3 decimal places. (Pressing the key again resets to a display with 2 decimal places.)		
		1x	
3. Confirming setting	Press the CLEAR key in order to confirm the desired decimal place display format.	1x	

Cleaning

The instrument must be cleaned in the following situations to assure correct operation:

- immediately, if the hand wheels become harder than usual to turn
- before changing the reagent
- prior to long term storage
- prior to dismantling the instrument
- regularly when using crystallizing liquids
- if liquid has accumulated in the screw cap of the titration tube

Warning!

The glass cylinder, valves, telescoping filling tube and titrating tube contain reagent! Follow the safety instructions (see page 36)!

Standard Cleaning

1. Hold a suitable receiving vessel below the opening of the titrating tube. Empty the instrument completely by turning the hand wheels.
2. Screw the instrument onto a bottle filled with deionized water, and set the valve to 'Titrate' (Fig. 2).
3. Place a suitable receiving vessel below the opening of the titrating tube, and rinse the instrument several times by completely filling and emptying it (Fig. 3).
4. Set the valve to 'Recirculation' (Fig. 4), and rinse the instrument several times by completely filling and emptying it.
5. This process can optionally be repeated with a suitable cleaning agent.
6. Next, rinse again with deionized water.
7. Screw the burette onto an empty bottle. Empty the piston completely by executing several up and down motions on the instrument (Fig. 7).
8. Set the valve to 'Titrate', place a suitable receiving vessel under the titrating tube, and empty the titrating tube.



Intensive Cleaning

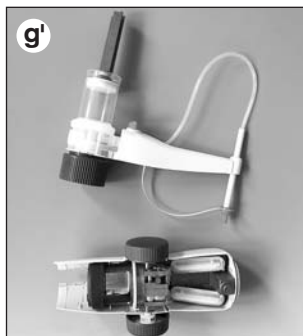
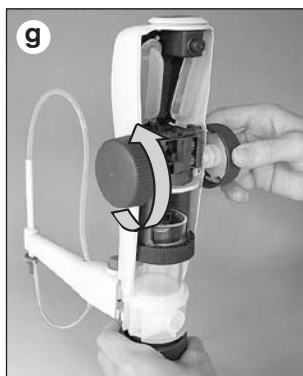
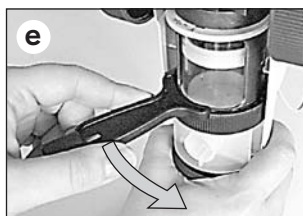
Warning!

The dispensing cylinder, valve, telescoping filling tube and titrating tube are filled with reagent! For this reason, always perform a standard cleaning before dismantling the instrument. Follow the safety instructions (see page 36)!

In order to avoid confusion about the components, do not dismantle more than one instrument at a time. A calibration, and any necessary adjustment, must be carried out after dismantling or replacement of a piston/cylinder assembly.

1. Removing the upper part of the housing

- a) Pull out the recirculation tube and the telescoping filling tube.
- b) Unscrew the air vent cap by hand or use a coin.
- c) Remove the rear housing and take out the mounting tool.
- d) Move the piston all the way to the top.
- e) Loosen the safety ring of the piston/cylinder assembly with the mounting tool, and unscrew it completely by hand (Fig. e).
- f) Withdraw the locking mechanism of the piston rod up to the stop (Fig. f).
- g) Move the top part of the instrument all the way to the top by turning the hand wheels, and remove it (Figs. g + g').



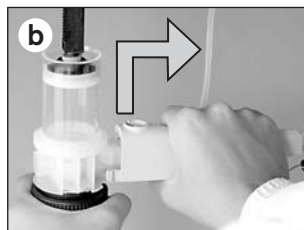
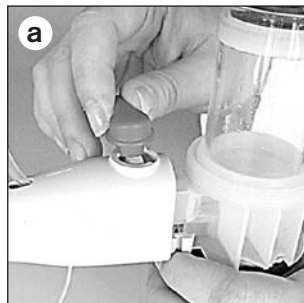
Note: Crystallizing solutions e.g., KOH in alcohol

After titration always fill the instrument up to the upper position again. Depending on the frequency of use, we recommend that any crystalline deposits on top of the piston be removed at regular intervals of approx. 8 weeks.

1. For this, the piston should be moved all the way up and then down by a half-rotation of the hand wheel.
2. Remove the top part of the housing.
3. Remove crystal deposits at the upper edge of the dispensing cylinder with water and a soft bottle-brush.
4. Then, dry it off with cellulose paper.
5. If necessary, dismantle it further.

2. Removing and Cleaning / replacing titration tube

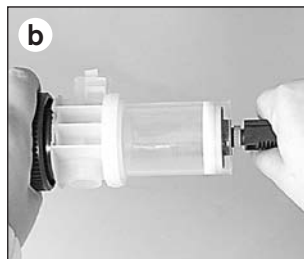
- a) Set the valve to 'Recirculate' and pull the valve lever upwards (Fig. a).
- b) Hold the titrating tube as shown in the figure. To disconnect the housing, press the titrating tube upwards to the stop, then use gentle up and down motions to pull it forward (Fig. b).
- c) The titrating tube with integrated discharge valve should be cleaned in an ultrasonic bath, or replaced.



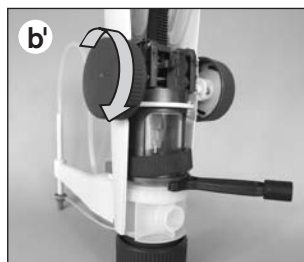
3. Cleaning / replacing the piston/cylinder assembly

The piston/cylinder assembly consists of a piston and a dispensing cylinder with a valve block. If liquid is above the piston, then the piston should be replaced. We always recommend to replace the complete piston/cylinder assembly.

- a) Remove possible crystal deposits at the upper edge of the dispensing cylinder with water and a soft bottle-brush.
- b) Hold the piston rod and slowly pull the piston out from the dispensing cylinder (Fig. b).

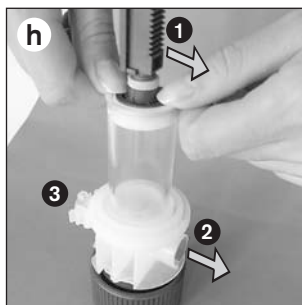
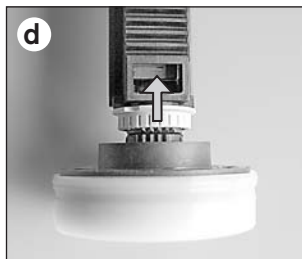
**Note:**

If it is difficult to move the piston open the top of the instrument, clamp the mounting tool (teeth point above) between the dispensing cylinder and the top, and turn the hand wheel to move the piston completely out of the dispensing cylinder (Fig. b').



- c) Use a soft cloth to clean the dispensing cylinder and piston, or replace them.
- d) To replace the piston, first slide the light grey safety ring of the piston rod upwards (Fig. d), and then unscrew the piston head (Fig. d').
- e) Screw a new piston onto the piston rod, and tighten it securely.
- f) Line up the piston gears and those of the piston rod, turning the piston back a maximum of half a gear tooth to accomplish this (Fig. d).
- g) Slide the safety ring of the piston rod **downwards**.
- h) Orient the toothed rack (1) of the piston rod in the direction of the air vent opening (2) of the valve block. This is found opposite the titrating tube connection (3). Carefully insert the piston vertically into the cleaned or replaced dispensing cylinder and press it about half-way in (Fig. h).

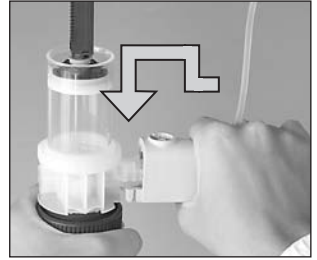
Note: The sealing lip of the piston must not be damaged. Contact with hard objects should be avoided!



4. Mounting the titrating tube

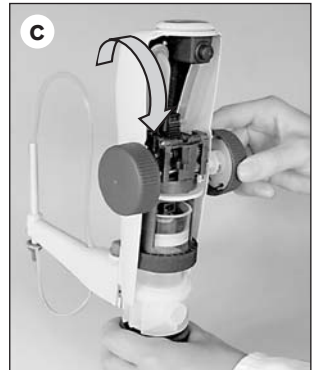
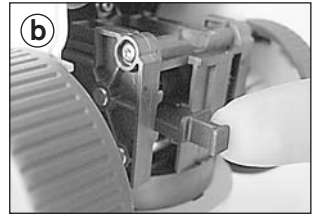
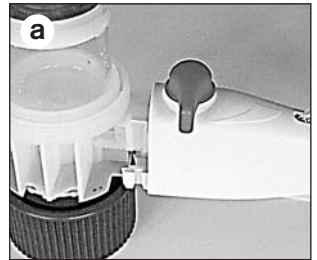
Mounting the cleaned or replaced titrating tube

- 1.) Push in the titrating tube approx. 5 mm.
- 2.) Slide up the housing of the titrating tube to the upper stop.
- 3.) Push the titrating tube in completely.
- 4.) Slide the titrating tube housing down to lock into place.



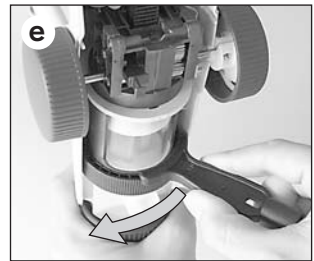
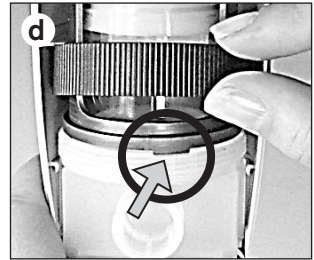
5. Mounting the top part of the housing

- a) Pull up the valve lever to the 'Recirculate' position, and press it in tightly (Fig. a).
- b) Check that the piston rod bar has been pulled out (Fig. b).
- c) Attach the top part of the instrument, and rotate the hand wheels to move it down while being careful that the recess of the front casing slides snugly over the titrating tube. Rotate the top part slightly if necessary (Fig. c).



(Continued on next page)

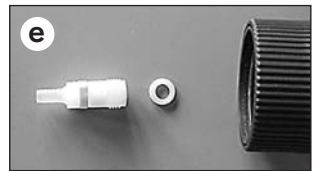
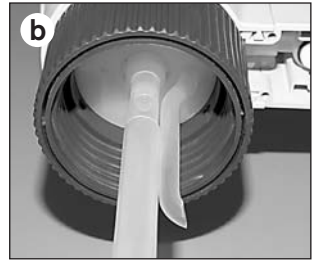
- d) Lift the safety ring of the piston/cylinder assembly and check that the nut and bolt mesh securely. Then, screw in the safety ring hand tight (Fig. d).
- e) Set the mounting tool on the right-hand edge of the housing, and tighten it towards the left-hand edge (Fig. e).
Replace the mounting tool into the rear housing for storage.
- f) Slide in the piston rod locking mechanism to the stop.
- g) Connect the rear housing firstly at the top, then snap it closed and screw in the air vent cap.
- h) Carry out a function check and calibration, and make any necessary adjustments.



6. Cleaning / replacing the filling valve

Always perform a standard cleaning before dismantling the instrument!

- a) Remove the rear housing and take out the mounting tool.
- b) Pull out the telescoping filling tube and the recirculation tube (Fig. b).
- c) Use the mounting tool to unscrew the filling valve (Fig. c).
- d) If the sealing ring is contaminated or damaged, carefully remove it with a pair of curved forceps (Fig. d).
- e) Clean the filling valve and sealing ring in an ultrasonic bath, or replace them (Fig. e).
- f) Insert the cleaned or new sealing ring, if necessary (as in Fig. e).
- g) Screw in the filling valve first by hand (Fig. g) and then tighten it with the mounting tool (1/4 turn is sufficient).



Note:

If the instrument does not fill up, and if some elastic resistance is evident when the piston is rotated upward, then it is possible that the ball valve is merely stuck. In this case, loosen the ball valve using light pressure, for example, with a 200 µl plastic pipette tip (see the figure at the side).

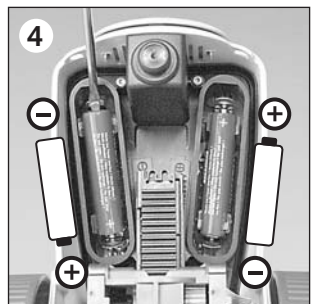
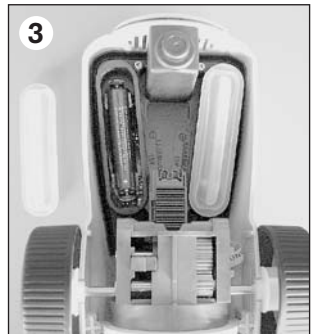
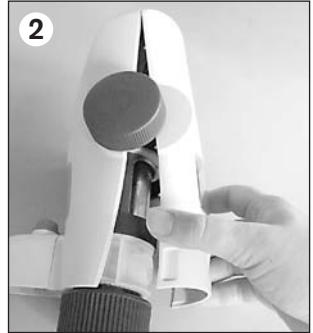


Replacing the batteries

A blinking battery symbol will show on the display if the battery capacity is depleted. The batteries should then be replaced.

Use only the specified battery type: 1.5 V (AAA/UM4/LR03) micro-battery. Batteries are not rechargeable.

1. Unscrew the air vent cap by hand or use a coin (Fig. 1).
2. Remove the rear housing (Fig. 2).
3. Remove the battery case cover (Fig. 3).
4. Remove the spent batteries using a screwdriver (Fig. 4).
5. Insert the new batteries and press them firmly into the holders. Observe the correct polarity of the batteries (Fig. 4).
6. Close the battery case covers tightly. Carefully press the edges of the covers.
7. Connect the housing at the top, then snap it closed and screw in the air vent cap.



Warning!

Dispose of batteries only when completely discharged, and according to applicable regulations. Do not short-circuit the batteries to discharge them – this is an explosion hazard!



Titrette®

	Standard	with RS 232 interface
Volume	Cat. No.	Cat. No.
25 ml	4760 151	4760 251
50 ml	4760 161	4760 261



Bottle adapter, PP. Pack of 1.

Outer-thread	For bottle thread/ size	Cat. No.
GL 32	GL 28	7043 28
GL 32	GL 30	7043 30
GL 45	GL 32	7043 96
GL 45	GL 38	7043 97
GL 45	S* 40	7043 43
GL 32	NS 24/29	7044 24
GL 32	NS 29/32	7044 29

* buttress thread

Titration tube with screw cap and integrated discharge and recirculation valve.
Pack of 1.

Cat. No. 7075 26



Filling valve with olive-shaped nozzle and sealing ring.
Pack of 1.

Cat. No. 6636



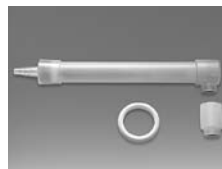
Screw cap with strap.
Pack of 1.

Cat. No. 7075 28

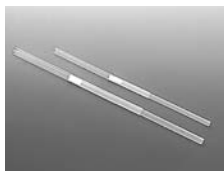


Drying tube with sealing-ring (without drying agent).
Pack of 1.

Cat. No. 7079 30



Telescoping filling tube, FEP. Pack of 1.



Recirculation tube,
pack of 1.



Cat. No. 8317

Length	Cat. No.
170 - 330 mm	7042 04
250 - 480 mm	7042 05

Piston,
pack of 1.



Dispensing cylinder with valve block.



For volume	Cat. No.
25 ml	7075 30
50 ml	7075 32

For volume	Cat. No.
25 ml	7075 34
50 ml	7075 36

Inspection window,
one set colorless and
one set brown colored
(light shield).



Air vent cap,
pack of 1.



Cat. No. 6783

Cat. No. 6659

Mounting tool,
pack of 1.



Micro-batteries, 1.5 V
non-rechargeable
(AAA/UM4/LR03).
Pack of 2.



Cat. No. 6784

Cat. No. 7260

For instruments with a PC interface

Connection cable
RS 232
Length 2 m
pack of 1.



Titrette® software
CD-ROM
German/English
pack of 1.



Cat. No. 8850

Cat. No. 7075 38

Troubleshooting

Problem	Possible cause	Corrective action
Liquid is above the piston	Piston worn	Perform a cleaning, replace the piston/cylinder assembly (see page 56).
Piston difficult to move	Piston/cylinder assembly is contaminated or damaged by crystalline deposits	Perform a cleaning, replace the piston/cylinder assembly, if necessary (see page 56).
Filling not possible	Filling valve stuck	Clean the filling valve. If the valve ball is stuck use a 200 µl plastic pipette tip to loosen it (see page 60).
Filling not possible / liquid is drawn back into the titrating tube during filling	The discharge valve is contaminated or the titrating tube has been damaged	Clean the discharge valve or exchange the titrating tube (see page 56).
Air bubbles in the instrument	Instrument filled too quickly	Fill instrument slowly
	Filling tube is loose or damaged	Fasten the telescoping filling tube firmly. If necessary, cut the tube off approx. 1 cm from the top or replace it.
	Filling valve is loose or the seal possibly has not been inserted	Check whether the seal has been inserted, and fasten the valve securely with the mounting tool.
	Filling tube does not dip into the liquid	Fill up the bottle, or correctly adjust the length of the telescoping filling tube.
	Recirculation tube is not mounted or mounted improperly	Attach the recirculation tube. The opening must point outward toward the bottle wall.
Titration not possible	Discharge valve stuck	Clean or exchange the titrating tube with its integrated discharge valve (see page 56).
The volume delivered is smaller than that indicated	The instrument has not been completely primed	Prime the instrument again (see page 41).
	Seal might not have been inserted or the filling valve is loose	Check whether the seal has been inserted, and fasten the valve securely with the mounting tool.
	Filling valve is blocked or damaged	Clean, and if necessary replace the filling valve (see page 60).
The instrument doesn't indicate any function	Internal error	Perform a restart: remove the batteries, wait 1 minute and then replace them (see page 61).

If a problem cannot be fixed by following the troubleshooting guide, or by replacing spare parts, then the instrument must be sent in for repair.

For safety reasons, instruments returned for checks and repairs must be clean and decontaminated!

Return for Repair

- a) Clean and decontaminate the instrument carefully.
- b) Complete the 'Declaration on Absence of Health Hazards' (ask your supplier or manufacturer for the form. The form can also be downloaded from www.brand.de).
- c) Send the completed form along with the instrument to the manufacturer or to the dealer with an exact description of the type of malfunction and the media used.

The return transport of the instrument is at risk and cost of the sender.

Calibration Service

ISO 9001 and GLP guidelines require regular examinations of your volumetric instruments. We recommend checking the volume every 3-12 months. The interval depends on the specific requirements on the instrument. For instruments frequently used or in use with aggressive media, the interval should be shorter. The detailed testing instruction can be downloaded on www.brand.de. BRAND also offers you the possibility to have your instruments calibrated by the BRAND Calibration Service or the BRAND-owned DKD Calibration Service. Just send in the instruments to be calibrated, accompanied by an indication of which kind of calibration you wish. Your instruments will be returned within a few days together with a test report (BRAND Calibration Service) or with a DKD/DAkkS* Calibration Certificate. For further information, please contact your dealer or BRAND. Complete ordering information is available for download at www.brand.de (see Technical Documentation).

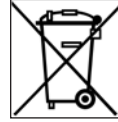
* Based on the legal requirements the DKD Accreditation is successively transformed to the DAkkS Accreditation (Deutsche Akkreditierungsstelle GmbH), starting from January 1, 2010.

Warranty

We shall not be liable for the consequences of improper handling, use, servicing, operation or unauthorized repairs of the instrument or the consequences of normal wear and tear especially of wearing parts such as pistons, seals, valves and the breakage of glass as well as the failure to follow the instructions of the operating manual. We are not liable for damage resulting from any actions not described in the operating manual or if non-original parts have been used.

Disposal

The adjoining symbol means that storage batteries and electronic devices must be disposed of separately from household trash (mixed municipal waste) at the end of their service life.



- According to the Directive 2002/96/EC of the European Parliament and of the Council on Waste Electrical and Electronic Equipment (WEEE) of 27 January 2003, electronic equipment requires disposal according to the relevant national disposal regulations.
- Batteries contain substances that can have harmful effects on the environment and human health. Therefore according to the Directive 2006/66/EC of the European Parliament and the Council on Waste Batteries of 6 September 2006 batteries require disposal according to the relevant national disposal regulations. Dispose of batteries only when completely discharged.

Warning!

Do not short-circuit the battery to discharge it!



普兰德® (上海) 贸易有限公司

普兰德® (上海) 是BRAND®在中国的子公司。

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