

Gebrauchsanleitung

Kolbenburette
TITRONIC® *universal*

Operating Instructions

Piston Burette
TITRONIC® *universal*

Mode d'emploi

Burette à piston
TITRONIC® *universal*

Manual de instrucciones

Bureta de émbolo
TITRONIC® *universal*



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Gebrauchsanleitung Seite 1 ... 24

Wichtige Hinweise: Die Gebrauchsanleitung vor der ersten Inbetriebnahme der Kolbenburette TITRONIC® *universal* bitte sorgfältig lesen und beachten. Aus Sicherheitsgründen darf die Kolbenburette TITRONIC® *universal* ausschließlich nur für die in dieser Gebrauchsanleitung beschriebenen Zwecke eingesetzt werden.

Bitte beachten Sie auch die Gebrauchsanleitungen für die anzuschließenden Geräte.

Alle in dieser Gebrauchsanleitung enthaltenen Angaben sind zum Zeitpunkt der Drucklegung gültige Daten. Es können jedoch von SCHOTT sowohl aus technischen und kaufmännischen Gründen, als auch aus der Notwendigkeit heraus, gesetzliche Bestimmungen der verschiedenen Länder zu berücksichtigen, Ergänzungen an der Kolbenburette TITRONIC® *universal* vorgenommen werden, ohne daß die beschriebenen Eigenschaften beeinflußt werden.

Operating Instructions Page 25 ... 48

Important notes: Before initial operation of the Piston Burette TITRONIC® *universal* please read and observe carefully the operating instructions. For safety reasons the Piston Burette TITRONIC® *universal* may only be used for the purposes described in these present operating instructions.

Please also observe the operating instructions for the units to be connected.

All specifications in this instruction manual are guidance values which are valid at the time of printing. However, for technical or commercial reasons or in the necessity to comply with the statutory stipulations of various countries, SCHOTT may perform additions to the Piston Burette TITRONIC® *universal* without changing the described properties.

Mode d'emploi Page 49 ... 72

Instructions importantes: Prière de lire et d'observer attentivement le mode d'emploi avant la première mise en marche de la Burette à piston TITRONIC® *universal*. Pour des raisons de sécurité, la Burette à piston TITRONIC® *universal* pourra être utilisé exclusivement pour les usages décrits dans ce présent mode d'emploi.

Nous vous prions de respecter également les modes d'emploi pour les appareils à connecter.

Toutes les indications comprises dans ce mode d'emploi sont données à titre indicatif au moment de l'impression. Pour des raisons techniques et/ou commerciales ainsi qu'en raison des dispositions légales existantes dans les différents pays, SCHOTT se réserve le droit d'effectuer des suppléments concernant la Burette à piston TITRONIC® *universal* qui n'influencent pas les caractéristiques décrits.

Manual de instrucciones Página 73 ... 96

Instrucciones importantes: Primeramente, lean y observen atentamente el manual de instrucciones antes de la primera puesta en marcha de la Bureta de émbolo TITRONIC® *universal*. Por razones de seguridad, la Bureta de émbolo TITRONIC® *universal* sólo debe ser empleada para los objetivos descritos en este manual de instrucciones.

Por favor, respeten las indicaciones descritas en los manuales de instrucciones de los equipos antes de conectarlos.

Todos los datos contenidos en este manual de instrucciones son datos orientativos que están en vigor en el momento de la impresión. Por motivos técnicos y / o comerciales, así como por la necesidad de respetar normas legales existentes en los diferentes países, SCHOTT puede efectuar modificaciones concernientes a la Bureta de émbolo TITRONIC® *universal* sin cambiar las características descritas.

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Typ / Type / Type / Tipo:

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Bescheinigung des Herstellers

Wir bestätigen, daß das oben genannte Gerät gemäß DIN EN ISO 9001, Absatz 4.10.4 "Endprüfung" geprüft wurde und daß die festgelegte Qualitätsanforderung an das Produkt erfüllt wird.

Supplier's Certificate

We certify that the equipment EN ISO 9001, part 4.10.4 "Final inspection and testing" and that the specified requirements for the product are met.

Certificat du fournisseur

Nous certifions que le produit a été vérifié selon EN ISO 9001, partie 4.10.4 "Contrôles et essais finals" et que les exigences spécifiées pour le produit sont respectées.

Certificado del fabricante

Nosotros certificamos que el equipo está verificada conforme a EN ISO 9001, parte 4.10.4 "Inspección y control final" y que las especificaciones requeridas para el equipo son respetadas y cumplidas.

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Operating Instructions

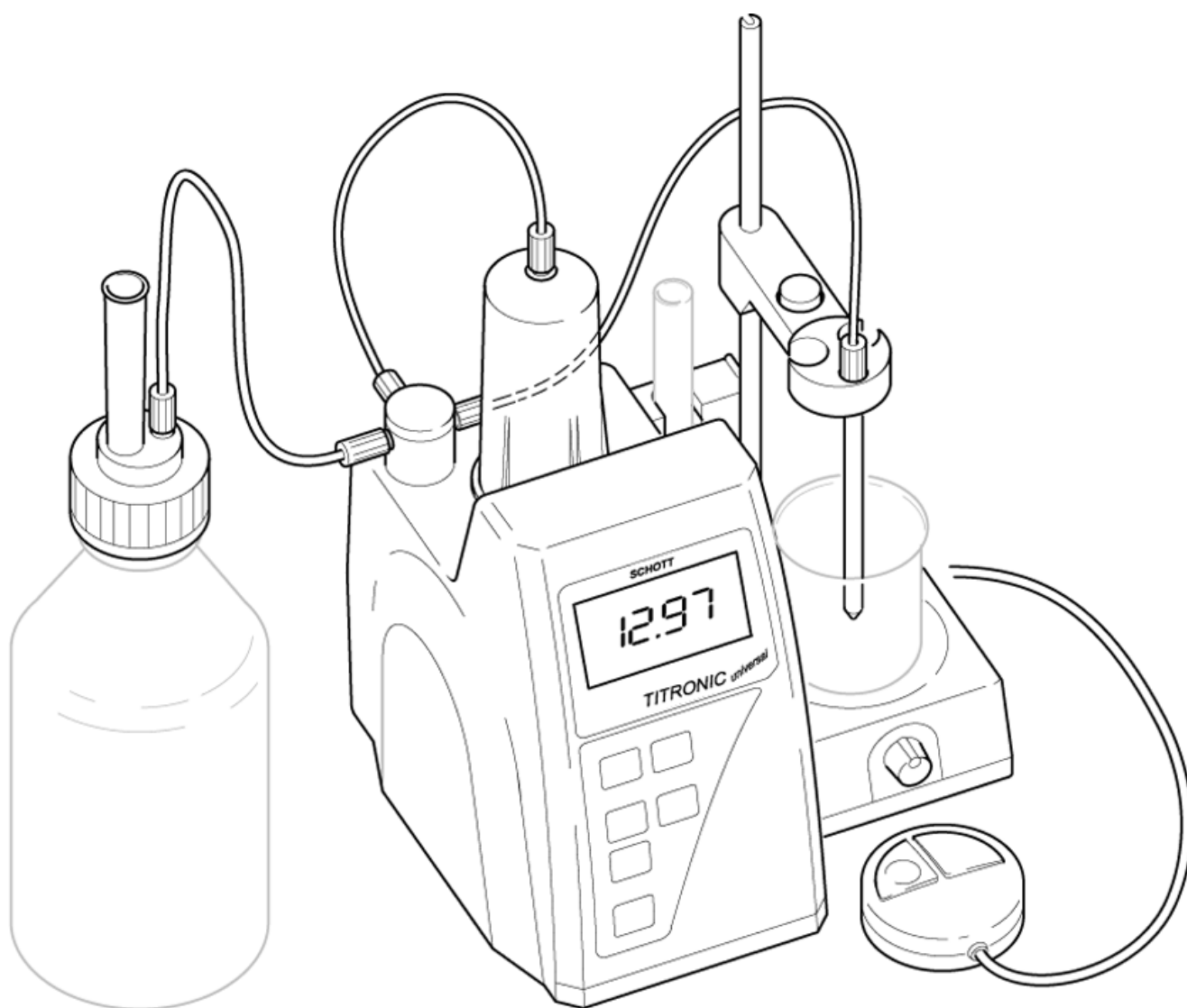
TITRONIC® *universal* Piston Burette

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Fig. 1 TITRONIC® *universal* Piston Burette

with TM 96 Stirrer
with manual key button
with stand
with electrode / burette-tip holder
with burette tip TZ 1503
with bottle top TZ 2005



1 Properties of the TITRONIC® *universal* Piston Burette

1.1 General

The TITRONIC® *universal* Piston Burette which requires just the space of a DIN A4 sheet can be used to carry out all common titrations, dosing processes as well as incremental dosing in a simple manner.

The accurately functioning dosing system meets the essential precondition for correct titration and dosing. In addition to the high-precision glass cylinder made of DURAN® borosilicate glass, the play-free motor/spindle system ensures correct dosing, incremental dosing, and titration results.

Incremental dosing offers furthermore the use in balance reactions and as an electronic dropping funnel.

The very simple operator prompting allows you uncomplicated working. The display will ask you to select the respective function or to set the corresponding parameters. Even during the execution of a function the burette's display will keep you at any time informed about its present status.

The two RS-232-C interfaces enable series daisy chaining of more than one TITRONIC® *universal* Piston Burettes for connection to a computer (PC).

The TM 96 Stirrer and the TZ 3665 Stand Rod attach directly to the TITRONIC® *universal* Piston Burette. The electrical contacts (15 V =) connect automatically when the stirrer is being installed. This means that the electrical power for the TM 96 Stirrer is supplied from the TITRONIC® *universal* Piston Burette.

All parts coming into contact with the titration and dosing solutions are made of chemically resistant materials. Analysis accuracy is guaranteed by the high-precision glass cylinder and the spindle for the piston feed. The controlled three/two-way valve, the easy-to-read consumption display with its additional status messages, the stand/stirrer system, and the practical manual key button make the TITRONIC® *universal* Piston Burette a device with comfortable use properties.

Within the present operating instructions, the TITRONIC® *universal* Piston Burettes with 20 ml or 50 ml cylinder are collectively referred to as TITRONIC® *universal* Piston Burette.

1.2 Dosing and titration solutions

To save titration solution and to render the disposal of the chemicals after the analysis as simple as possible, we recommend to select any titration-solution consumption between 5 ml and a 15 ml for titration

Solutions to be used:

In practice, any solutions and liquids with the viscosity of $\leq 10 \text{ mm}^2 / \text{s}$ can be used, such as e.g. concentrated sulphuric acid. However, chemicals attacking glass, PTFE, or FEP, or which are explosive, such as hydrofluoric acid, sodium azide, or bromine must not be used! Suspensions with a high solid contents may block or damage the dosing system.

General rules:

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

Notes: When used in this text, the following signs have the following meaning:



= note on possible danger

<< ... >>

= contents of the display

< >

= key



= please refer to, for instance, figure, chapter, operating instructions

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KONFORMITÄTSERKLÄRUNG DECLARATION OF CONFORMITY DÉCLARATION DE CONFORMITÉ

Wir erklären in alleiniger Verantwortung, daß das Produkt

We declare under our sole responsibility that the product

Nous déclarons sous notre seule responsabilité que le produit

Kolbenbürette

Piston Burette

Burette à piston

TITRONIC®
universal

TITRONIC®
universal

TITRONIC®
universal

auf die sich diese Erklärung bezieht, übereinstimmt mit den Normen

to which this declaration relates is in conformity with the standards

auquel se réfère cette déclaration est conforme aux normes

DIN 12 650, Teil 5
und / and / et
ISO DIS 8655

und mit dem normativen Dokument

and the normative document


et au document normatif

Technische Daten
Kolbenbürette TITRONIC® *universal*

01. Juni 1999

SCHOTT-GERÄTE GmbH
Hattenbergstraße 10
55122 Mainz
Deutschland, Germany, Allemagne

Technical data **TITRONIC® *universal* Piston Burette** Stand June 01, 1999

Conformity:	DIN 12 650, Part 5, conformity sign	
CE sign:	<p>EMC compatibility according to the Council Directive 89/336/EWG;</p> <p>Generic emission according to EN 50 081, Part 1</p> <p>Generic immunity according to EN 50 082, Part 2</p> <p>Low-voltage directive according to the Council Directive 73/23/EWG, last modified by the Council Directive 93/68/EWG</p> <p>Testing basis EN 61 010, Part 1</p>	
Country of origin:	Made in Germany	
Dosing unit:		
Cylinder:	<p>TITRONIC® <i>universal</i> Piston Burette: 20 ml DURAN® (borosilicate glass) cylinder</p> <p>TITRONIC® <i>universal</i> Piston Burette: 50 ml DURAN® (borosilicate glass) cylinder</p>	
UV protection:	Protective coating made of Ultem 1000, colour: amber	
Valve:	Motor-driven 3/2-way valve made of PTFE / ETFE	
Hoses:	FEP with UV protection	
Dosing accuracy:	0,15 %, referred to the nominal volume, according to DIN 12 650, Part 5; indicated as a measurement uncertainty with a confidence level of 95 %	
Volume display:	TITRONIC® <i>universal</i> / 20 ml respectable TITRONIC® <i>universal</i> / 50 ml: 5 leading and 2 trailing decimal digits with a resolution of 0.01 ml	
Display:	Matrix LCD display 69 x 39 mm, 64 x 128 pixels with background lighting, contrast can be set using a knurled wheel	
Connections:		
Manual key button:	Plug connection: 4-channel mini DIN round plug	
Stirrer:	Plug connection with integrated low-voltage supply (15 V =) for the TM 96 Stirrer incorporated in the bottom of the casing of the TITRONIC® <i>universal</i> Piston Burette	
RS-232-C interfaces:	<p>Two bi-directional RS-232-C interfaces</p> <p>Plug connections: 4-channel round plug mini DIN</p> <p>Configuration of the RS-232-C interfaces: fixed settings: 1 stop bit</p> <p>Adjustable: Baud: 1200, 2400, 4800 or 9600 baud;</p> <p>Word length: 7 or 8; parity: no, even or odd; address: 00 ... 15</p>	
Power supply:	<p>Corresponds to protective system II according to DIN EN 61 010, Part 1, not suitable for use in environment with explosion hazard</p> <p>Mains: 230 V~, 50 / 60 Hz; if specified on the order 115 V~; 50 / 60 Hz</p> <p>Power draw: 18 VA</p>	
Materials: Casing:	Polypropylene	
Front foil:	Polyester	
Casing dimensions:	135 x 310 x 205 mm (w x h x d), height incl. cylinder, excluding stirrer	
Weight:	approximately 2.1 kg	
Ambient conditions:	<p>Ambient temperature: + 10 ... + 40 °C for operation and storage</p> <p>Humidity according to EN 61 010, Part 1:</p> <p>Max. relative humidity 80 % for temperatures up to 31 °C, linear decrease down to 50 % relative humidity at a temperature of 40 °C</p>	

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2 Warning and safety information

The TITRONIC® *universal* Piston Burette corresponds to protection class II. It was manufactured and tested according to DIN EN 61 010, Part 1, Protective Measures for Electronic Measurement Devices and has left the factory in an impeccable condition as concerns safety technology. In order to maintain this condition and to ensure safe operation, the user should observe the notes and warning information contained in the present operating instructions. Development and production is done within a system which meets the requirements laid down in the DIN EN ISO 9001 standard.

For reasons of safety, the TITRONIC® *universal* Piston Burette must be opened by authorised persons only; this means, for instance, that work on electrical equipment must only be performed by qualified specialists.

⚠ In the case of nonobservance of these provisions the TITRONIC® *universal* Piston Burette may constitute a danger: electrical accidents of persons or fire hazard. Moreover, in the case of unauthorised intervention in the TITRONIC® *universal* Piston Burette as well as in the case of negligently or deliberately caused damage, the warranty will become void. ⚠

Prior to switching the device on it has to be ensured that the operating voltage of the TITRONIC® *universal* Piston Burette matches the mains voltage. The operating voltage is indicated on the specification plate. Nonobservance of this provision may result in damage to the TITRONIC® *universal* Piston Burette or in personal injury or damage to property.

If it has to be assumed that safe operation is impossible, the TITRONIC® *universal* Piston Burette has to be put out of operation and secured against inadvertent putting to operation. In this case please switch the TITRONIC® *universal* Piston Burette off, pull plug of the mains cable out of the mains socket, and remove the TITRONIC® *universal* Piston Burette from the place of work.

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

- ➡ the package is damaged,
- ➡ the TITRONIC® *universal* Piston Burette shows visible damages,
- ➡ the TITRONIC® *universal* Piston Burette does not function properly,
- ➡ liquid has penetrated into the casing.

The TITRONIC® *universal* Piston Burette must not be stored or operated in humid rooms.

For reasons of safety, the TITRONIC® *universal* Piston Burette must only be used for the range of application described in the present operating instructions.

In the case of deviations from the intended proper use of the device, it is up to the user to evaluate the occurring risks.

⚠ The relevant regulations regarding the handling of the substances used have to be observed: The Decree on Hazardous Matters, the Chemicals Act, and the rules and information of the chemicals trade. It has to be ensured on the side of the user that the persons entrusted with the use of the TITRONIC® *universal* Piston Burette are experts in the handling of substances used in the environment and in the TITRONIC® *universal* Piston Burette, or that they are supervised by specialised persons, respectively.

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

When the piston moves upwards within the cylinder, owing to the design of the system, a microfilm of dosing liquid or titration solution will always remain adhered to the inner wall of the cylinder, but this has no influence on the dosing accuracy. This small residue of liquid, however, may evaporate and thus penetrate into the zone underneath the piston, and if inadmitted liquids are being used, the materials of the TITRONIC® *universal* Piston Burette may be dissolved or corroded (please refer also to "Maintenance and Care").

The TITRONIC® *universal* Piston Burette is equipped with integrated circuits (EPROMs). X rays or other high-energy radiation may penetrate through the device's casing and delete the program.

Please note also the corresponding operating instructions for the devices to be connected.

3 Setting up and commissioning

3.1 Unpacking and setting up of the TITRONIC® *universal* Piston Burette

The TITRONIC® *universal* Piston Burette and all its accessories are ex-works thoroughly tested for correct functioning and dimensional accuracy and, apart from the TM 96 Stirrer, the stand rod and the manual key button, installed ready for operation.

Please note that also all the small accessories are taken out of the packing. For the scope of delivery, please refer to the packing list.

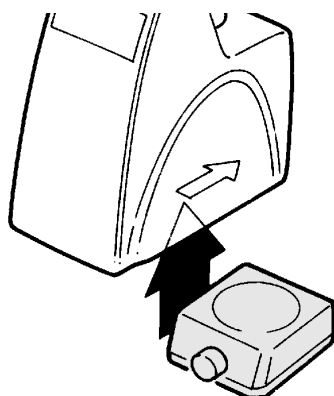
Set up the TITRONIC® *universal* Piston Burette on any flat surface, and connect the mains plug to the mains socket. Prior to plugging in the mains plug it has to be ensured that the operating voltage of the TITRONIC® *universal* Piston Burette matches the mains voltage. The operating voltage is indicated on the specification plate on the bottom of the TITRONIC® *universal* Piston Burette.

⚠ The piston burette is not suitable for use in explosive-hazardous environments. ⚠

3.2 Installation of the stirrer

The stirrer connects to the right side at the bottom and is locked in position by pushing it backwards (Fig. 2). In this way the power supply of the TM 96 Stirrer is automatically established.

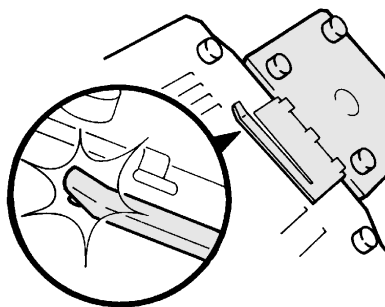
Fig. 2 Installation of the stirrer:



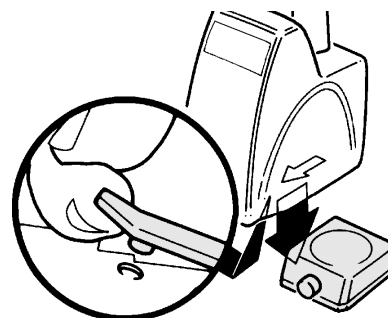
Insert the stirrer from below and upwards into the contact openings of the piston burette, then push the TM 96 Stirrer backwards until it latches in position.

TITRONIC® *universal* Piston Burette seen from below:

Fig. 3 and Fig. 4: Removing the stirrer:



Lift the latch slightly up, push the stirrer forwards, and pull it off downwards.



3.3 Installation of the stand

Insert the TZ 3665 Stand Rod at the right side (Fig. 5) and fasten it on the back panel of the TITRONIC® *universal* Piston Burette using the two included M3 x 10 mm screws (slot-screw driver). Install the electrode / titration-tip holder as is shown in Fig. 6.

Fig. 5 Installation of the stand

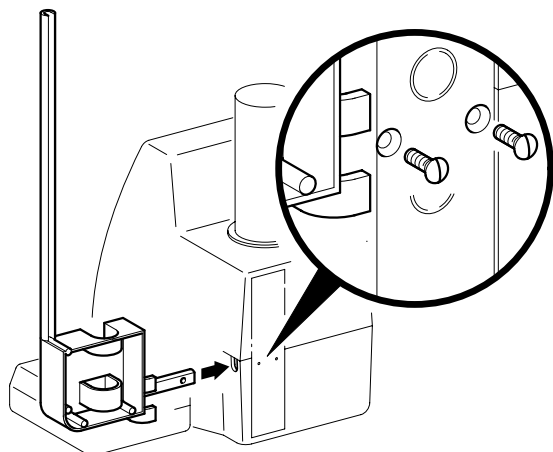
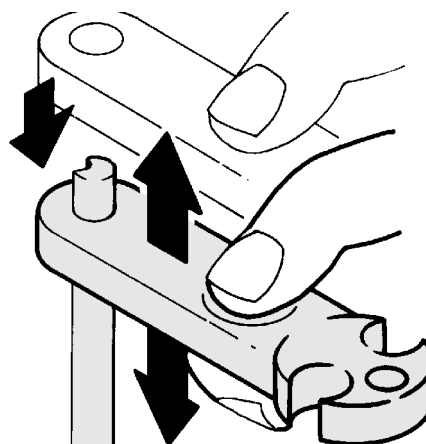
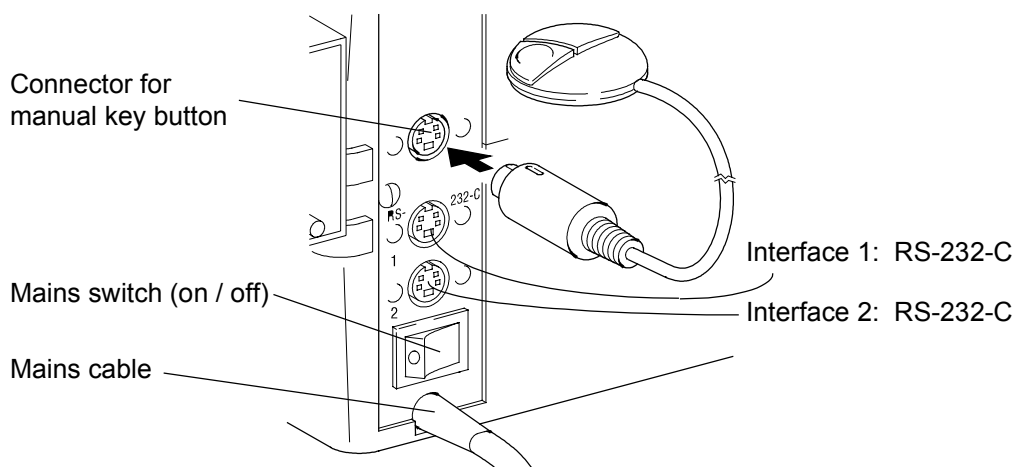


Fig. 6 Installation, lifting and lowering the electrode / titration-tip holder



3.4 Connecting the manual key button and a printer / computer (PC); switching on and off

Fig. 7



The transfer parameters for the RS-232-C interface can be selected according to "RS-232-C interface" chapter.

Attention: The design of the three 4-channel sockets is identical. If the plugs are interchanged, the electronics of the TITRONIC® *universal* Piston Burette may be damaged.

Upper socket: manual key button;

Middle socket: printer / computer (PC); –interface 1–

Lower socket: Daisy chaining of several TITRONIC® *universal* Piston Burettes, please refer to 'Daisy-changing of devices', chapter, –interface 2–

➤ Connect the mains plug to mains.

➤ The main switch is located on the back panel of the TITRONIC® *universal* Piston Burette.

4 Working with the TITRONIC® *universal* Piston Burette

Note: The signs as used in the text have the following meaning:

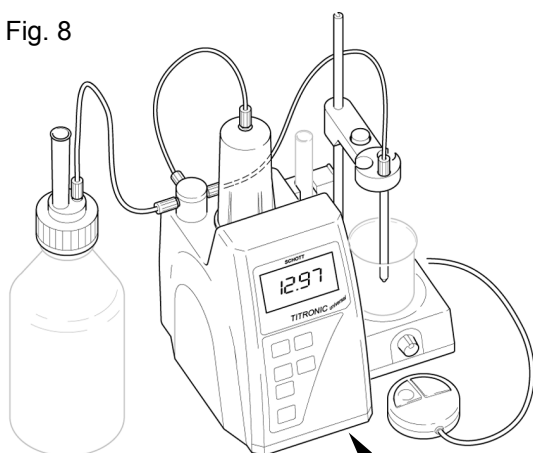
- ⚠ = note on possible danger
- << ... >> = contents of the display
- < > = key
- 📖 = please refer to, for instance, figure, chapter, operating instructions

During sucking in of dosing and titration solution one has to take care that the suction hose is immersed in the bubble-free solution in the storage bottle. If the TITRONIC® *universal* Piston Burette is already filled with ready-for-use solution, working can start right away.

If the TITRONIC® *universal* Piston Burette has to be filled first, 📖 “Rinsing and initial filling” chapter, this function is to be triggered using the <FILL> key. The display will signal the respective status of the current function.

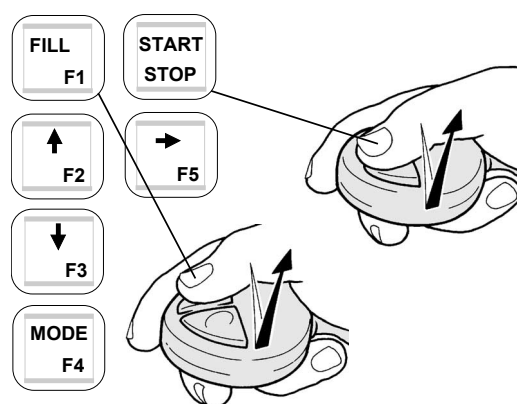
4.1 Keys and contrast

Fig. 8



Adjusting contrast

Fig. 9



All functions of the TITRONIC® *universal* Piston Burette are triggered using the keyboard. In dialogue mode, the display shows which active keys can be pressed for further work. The manual key button is used to start the „START/STOP“ and the „FILL“ function and to output the results.

You can adjust the contrast of the display text using the knurled wheel on the right side of the burette's front panel.

4.2 Switch-on image, setting the filling time

Fig. 10

```

TITRONIC universal
Ver.: 99.14

Cylinder volume 20 ml
Rins./init. fill.    <F1>
Filling 30 (s)      <F2>
System              <F3>
Menu                 <Mode>
  
```

After switching the TITRONIC® *universal* Piston Burette on, the switch-on image shows you the cylinder size and the software version. The switch-on image is shown for 15 seconds during which you can select a function.

Using the <F1> key you select „Rinsing/initial filling“, the <Mode> key selects a function such as „Dosing“, „Titration“, „Incremental dosing“. The <F2> key serves to select the setting for the filling time. Subsequently, the following display will appear:

Fig. 11

```

Setting filling time

Filling time:          030 s


Change digits:         <↑↓>
Next digit             <→>
OK:<F1>                 ESC:<F4>
  
```

You can use the <↑>, <→>, <↓> arrow keys on the front panel of the TITRONIC® *universal* Piston Burette to set a filling time off min. 30 s to max. 999 s. The display will show your modified values. The cursor is located below the digit to be changed. As soon as the cursor has reached the last digit to the right, it will jump back to the first digit to the left if the <→> arrow key is pressed again, display: <<Next digit>>. The filling time refers to the duration of one complete piston stroke during the drawing in off dosing or titration solution. This time is increased by the switching times of the valves of approximately 6 s. If you trigger the filling process with their contents of the cylinder not being fully ejected, "Filling" will be shortened correspondingly.

The <F3> key serves to select the national language or to set the parameters of the RS-232-C interface. After a waiting time of 15 seconds the burette will automatically switch to the last selected working method (function), e.g. „Dosing“ = <Mode>:Dos. The selected working method remains stored after the burette is switched off.

Display	Key	What is happening, and what is to be done?
Rinsing	<F1>	Double filling and ejection of the cylinder contents
Filling time	<F2>	Setting the filling time
System	<F3>	Selection of the national language, and setting of the serial parameters
Menu	<Mode>	Selection of the functions: Dosing, titration, and incremental dosing

4.3 Selection of the national language



For the display of the TITRONIC® *universal* Piston Burette you can select one of the following national languages: German, English, French, or Spanish. From the switch-on image,  Fig. 10, use the <F3> key to switch to the language selection. Then you press the <F1> key for 'Deutsch', the <F2> key for 'English', the <F3> key for 'Français', or the <F4> key for 'Español'.

Deutsch <F1>
 English <F2>
 Français <F3>
 Español <F4>

Pressing the <MODE / F4> key for approx. 3 s will get you to the switch-on image.

4.4 Rinsing and initial filling

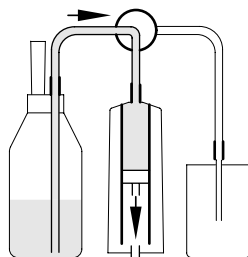
Considering that a max. of 100 ml of dosing or titration solution will be ejected during "Rinsing/Initial filling", **a vessel with a min. capacity of 100 ml has to be placed under the burette tip.**

 **Please note** : Please wear protective glasses and a laboratory coat and observe the UVV1 and UVV 113 (VBG) accident-prevention regulations as well as the pertinent implementation comments.

Starting the function

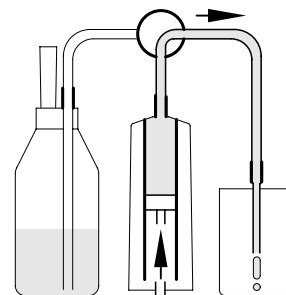
Fig. 12

TITRONIC universal	
Ver.: 99.14	
Cylinder volume 20 ml	
Rins./init. fill.	<F1>
Filling time 30 (s)	<F2>
System	<F3>
Menu	<Mode>



Press the <FILL> / <F1> key.

Fig. 13



To cancel the function: Press the <STOP> key.

The „Rinsing / Initial filling“ function will perform two draw-in and dosing cycles. The old solution will be flushed out of the cylinder, subsequently new liquid will be filled in. However, a change of solutions (e.g. caustic soda \Leftrightarrow hydrochloric acid) is not possible in this manner since the contents of the cylinder will not be ejected without residue, hence an intermixture with the new solution will take place. The respective working steps including notes on the further way of proceeding will be shown on the display.

You can interrupt the „Rinsing“ function at any time using the <START/STOP> key, with repeated pressing of the <START> key causing „Rinsing“ to continue. If you press the <F5> key, the rinsing process will be stopped definitely, and subsequently the cycle will be completed with the burette being filled.

It should be noted that the dosing or titration solution, when remaining in the hoses over longer periods time, may alter owing to the diffusion of constituents of the air. In cases of doubt you should also start the „Rinsing / Initial filling“ function.

Upon completion of filling, the TITRONIC® *universal* Piston Burette is ready for work.

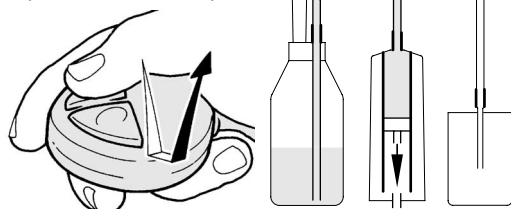
4.5 Filling

If the volume to be dosed or titrated exceeds 20 ml or 50 ml, respectively, the burette will refill automatically with the set „Filling time“ (📖 “Switch-on image, setting the filling time” chapter).

After the cancellation of one of the three functions of the TITRONIC® *universal* Piston Burette the display will show the respective basic menu of a function. Here you use the <FILL> or the grey key of the manual key button to start the „Filling“ function. Upon completion of the manually started „Filling“ function the display will automatically be reset to zero. In other cases the display of the volume will remain on the display, and the further consumption of dosing or titration solution will be added up to the volume display. You can influence the filling process using the adjustable filling time. In the case of liquids with a higher viscosity it is recommendable to set a longer filling time to prevent the formation of air bubbles; for concentrated sulphuric acid, for instance, a filling time of 60 - 90 s should be set.

Fig. 14

long
(2 seconds min.)



Filling

After the last pressing of a key, wait at least for 1 second, then press the grey key until "filling" starts. The TITRONIC® *universal* Piston Burette will fill within the set filling time, the display will be reset to 0.00 ml.

The piston burette will fill automatically as soon as the volume of 20.00 ml or 50.00 ml has been ejected and dosing or titration has not yet been completed. The display will show the total volume consumed in << 12.97 >>.

If a printer or a computer (PC) is connected, the displayed volume will be output in [ml].

Fig. 15

2 short clicks
(2 x 0.3 seconds max.)



Resetting the display to 0.00

After the last pressing of a key, wait at least for 1 second, then press the grey key twice at a short interval (0.3 s max.), the display will be reset to 0.000. If a printer or a computer (PC) is connected, the displayed volume will be transferred in [ml].

4.6 Setting the parameters

You can use the <↑>, <→>, <↓> arrow keys on the front of the TITRONIC® *universal* Piston Burette to set uniform parameters for all functions. The display will show your modified values. The cursor is located below the digit to be changed. As soon as the cursor has reached the last digit to the right, it will jump back to the first digit to the left if the <→> arrow key is pressed again, display: <<Next digit>>. The dialog of the <<YES:>> display will request you to store the new value using the <F1> key. With the display showing <<NO:>> you can reset the input to the last valid parameters by pressing the <F4> key.

Fig. 16

Dosing parameter	
Nominal vol.:	<u>0</u> 15.00ml
Change digit:	<↑↓>
Next digit	<→>
OK:<F1>	ESC:<F4>

Fig. 17

Dosing parameter	
Speed:	<u>4</u> 0.00ml/min
Change digits:	<↑↓>
Next digit	<→>
OK:<F1>	ESC:<F4>

The selection of the titration rate stages is an exception to this. Here you can use the <↑>, <↓> arrow keys for a direct selection of one of the 6 rate stages. The highest stage, e.g. 6, corresponds to approximately 40 ml/min for the 20 ml cylinder and to approximately. 100 ml/min in the case of the 50 ml design.

Rate stage	TITRONIC® <i>universal</i> Piston Burette		TITRONIC® <i>universal</i> Piston Burette	
	with 20 ml cylinder		with 50 ml cylinder	
		[ml/min]		[ml/min]
1	5		12.5	
2	6.6		16.5	
3	10		25	
4	13.3		33.3	
5	20		50	
6	40		100	

4.7 Titration

Note: Please switch on stirrer!

Press the <MODE> key so many times until the TITRONIC® *universal* Piston Burette shows the image with the "Titration" = <Mode>:Titr. Function.

Fig. 19

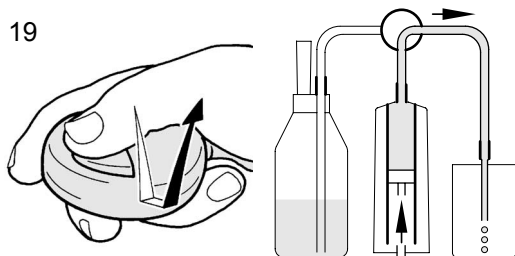


Fig. 20

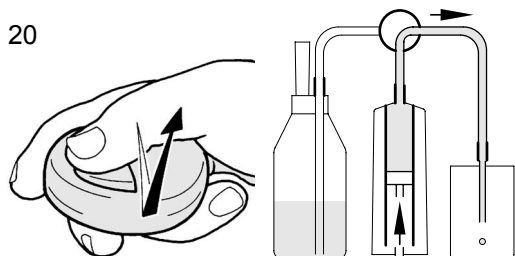


Fig. 21

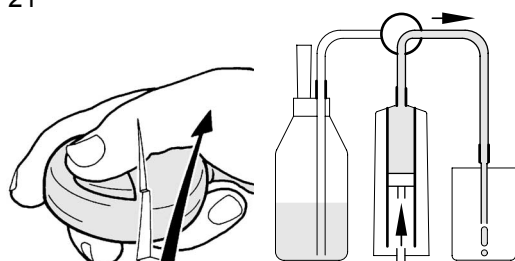


Fig. 18

<Mode>:Titr.	
8.37	ml
Speed level: 3	<↑↓>
Pretitr.: 6.00ml	<F5>
Titrate:	button man.
Pretitration	<Start>

Normal titration

Immerse the burette tip into the sample solution. This will increase accuracy.

Press the violet key down to the first stage (low speed), and keep it depressed. The titration solution will be added as long as the key is kept depressed, Fig. 19.

The display will show the volume, the titration rate is approximately 3 ml per minute.

0.01 ml - titration / incremental titration

Press the violet key shortly (0.3 s max.). 0.01 ml will be ejected with each pressing, Fig. 20.

The display will show the volume.

Fast titration

As long as the burette is in standstill, use the <↑>, <↓> arrow keys to select one of the 6 possible rate stages. The fastest stage is <<6>>.

Press the violet key fully down (including 2nd stage = high speed), and keep it depressed.

The titration solution will be dosed as long as the key is kept depressed.

The display will show the volume and the selected rate stage, with the fastest stage 6 representing a titration rate of approx. 40 ml or 100 ml per minute, respectively, table in „Setting the parameters“ chapter.

Pretitration

If you are aware of the minimum consumption of titration solution, you can set a pretitration volume from 0 to 99.99 ml for more convenient titration, please ref. to „Setting the parameters“ chapter.

Using the <START> key the burette will eject the set pretitration volume at maximum rate. You can at any time cancel the addition of the pretitration volume using the <STOP> key and then complete either titration with the manual key button or pretitration using the <START> key.

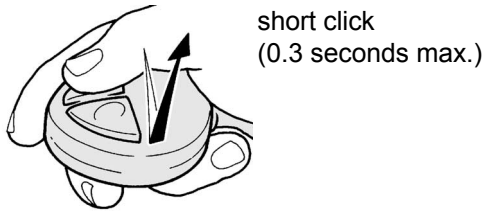
As soon as the pretitration volume is reached, an acoustic signal will be output. You can now use the manual key button to complete titration.

The display will show the total volume of used up titration solution.

During titration, you can also output the total volume in [ml] at the RS-232-C interface for documentation purposes.

Send results to printer / computer (PC)

Fig. 22



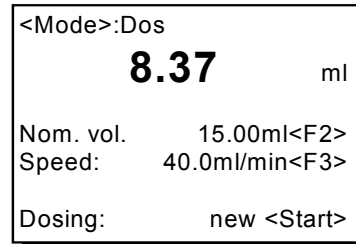
After pressing a key for the last time, wait at least for 1 second, then press the grey key once (3.0 seconds max.), and the displayed volume in terms of ml will be sent to the printer / computer.

The display remains on the screen, titration can be continued.

4.8 Dosing

Press the <MODE> key so many times until the display shows "<MODE>:Dos".

Fig. 23



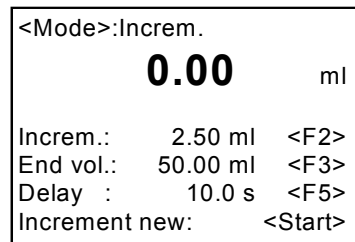
The „Dosing“ function will eject at an exactly definable speed (rate) a nominal volume which is adjustable from 0.01 to 999.99 ml. You can set this dosing speed (rate) from 0.5 to 40.0 ml/min in the case of the TITRONIC® *universal* / 20 ml Piston Burette, and to 0.5 to 99.9 ml/min in the case of the TITRONIC® *universal* / 50 ml Piston Burette. For the 20 ml burette the **max. rate is 40 ml/min**, for the 50 ml burette it is max. **99.9 ml/min**.

You set both the command volume and the dosing rate in a dialogue with the display of the TITRONIC® *universal* Piston Burette, „Setting the parameters“ chapter. The stored parameters remain active even after the burette is switched off.

4.9 Incremental dosing

Use the <MODE> key to select the „Incremental dosing“ function

Fig. 24

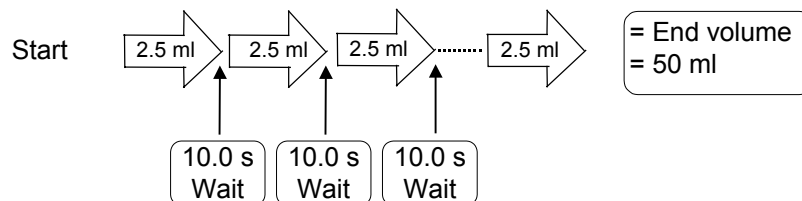


You set the parameters in a dialogue with the burette, „Setting the parameters“ chapter.

With incremental dosing **-Mode>:Increm-** you divide an adjustable end volume **-End vol.:-** into individual, adjustable volume steps **-Increm:-**, with a likewise adjustable waiting time **-Delay-** being inserted between the individual steps. The addition of the individual volume steps is displayed as total volume.

Fig. 25 Minimal and maximal set parameters:

	Example	Parameter	minimal	maximal
Volume of the individual steps	2.5 ml	Increment [ml]	0.01	99.99
Total volume	50 ml	End volume [ml]	0.01	999.99
Waiting time after each step	10 s	Waiting time [s]	0.5	999.9




If the increment is set to a value greater than the end volume, the burette will only dose 1 x “end volume”.

5 RS-232-C interfaces, inputs and outputs

5.1 General

The TITRONIC® *universal* Piston Burette is equipped with two serial RS-232-C interfaces for data communication with other devices. You can use these two interfaces to connect several devices to one computer (PC) interface.

The plug connectors of the two interfaces are located on the devices' back panel,  Fig. 7. RS-232-C socket "1" makes the connection to a connected computer, a printer with a serial interface, or to the upstream device within the "daisy chain". RS-232-C socket "2" can be used to connect additional devices (daisy chain concept).

PIN allocation of the RS-232-C interfaces:

PIN- Signification / description

No.

- 1 T x D Data out
- 2 R x D Data in
- 3 Digital ground

5.2 Setting the data-transfer parameters

All devices communicating with each other require the same transfer parameters. The following transfer parameters are set ex factory:

Baud rate: 4800 baud

Data bits: 7 Bit

Stop bits: 1

Parity: No.


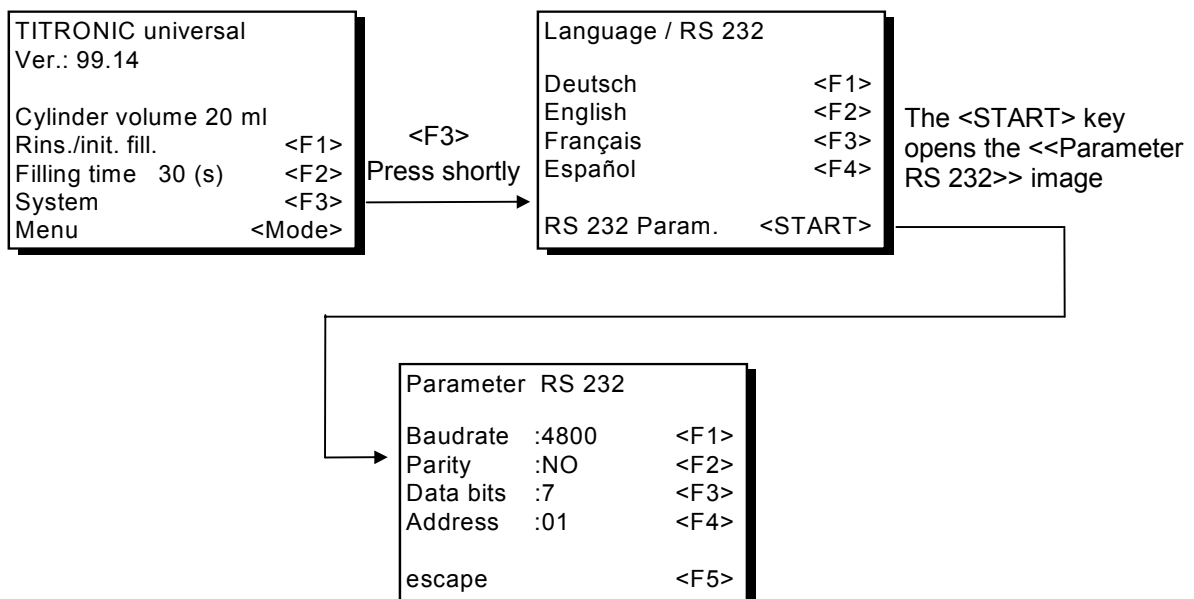

If you wish to change the data-transfer parameters, press the <MODE> key for approximately 3 seconds. The switch-on image offers you to select the "System" parameters using the <F3> key,  Fig. 26.


Fig. 26



Using the <F1> to <F4> keys, the burette offers you the possibility of changing the respective parameters for RS-232-C communication. In this context, too, the new settings are to be stored using the <F1> key. Subsequently, the <F5> or <MODE> keys will take you back to the function last selected.

5.3 Device address and daisy chaining of several TITRONIC® *universal* Piston Burettes — Daisy Chain Concept —

In order to enable you to individually address several devices in a chain, each of the devices must have an address of its own. To achieve this, one has first of all to use an RS-232-C data cable, e.g. no. TZ 3096 type, to establish a connection between the computer and the RS-232-C socket 1 (interface 1) of the first device in the chain. Using another RS-232-C data cable, no. TZ 3094 type, the RS-232-C socket 2 (interface 2) of the first device is connected to interface 1 of the second device,  Fig. 7. Additional devices can then be connected to the interface 2 of the second device.

The address always consists of 2 characters: e.g. address 1 of the two <0> and <1> ASCII characters. The address can be set from **00** to **15**, i.e. there are 16 possibilities. Please ensure that the addresses of the devices in the chain are different. If a device is addressed using its address, the device will work off this command without sending it to another device. The response to the computer or titrator also receives the own address. You can change the address from the <<Parameter RS 232>> menu using the <F4> key,  "Setting the data transfer parameters". The ex-factory set address of the TITRONIC® *universal* Piston Burette is 01.

The TITRONIC® *universal* Piston Burette will receive commands from a computer or titrators at interface **1**, if the latter carries this address, and this interface will also be used to return its response. If the address of the incoming commands does not match their device address, the entire command will be forwarded at interface **2**. This interface 2 is connected to interface 1 of another TITRONIC® *universal* Piston Burette. This piston burette, in turn, will now check the address and will respond to this command just like the first burette. Any information (data strings) arriving at the interface 2 of the TITRONIC® *universal* Piston Burette will be output at interface 1 to the computer or titrator immediately. This means that the computer will in any case receive the information of all burettes. In practice it is possible to connect up to 16 devices to a computer (PC) interface.

As has been mentioned above, the proper functioning of the daisy chain concept requires that each piston burette has an address consisting of 2 digits in a row.

5.4 Command list for RS communication

The commands are made up of the following 3 elements:	Address 2-digit aa,	e.g.: 01
	Command	e.g.: BP
	Variable, if required	e.g.: 14
	and end of command	<CR> <LF>

Each command has to end on the <CR> and <LF> (Carriage Return and Linefeed) ASCII characters. All responses will only be returned to the computer upon completion of the respective action.

Example: It is intended to send to the piston burette with the address 5 the command to dose 12.5 ml, with preceding filling of the cylinder and zero reset of the display.

The command consists of the following characters: 05DO12.5<CR LF>

Here is:

05	=	Device address
DO	=	Command for dosing with filling
12.5	=	Volume to be dosed in ml
<CR LF>	=	Control character for end of volume

All TITRONIC® *universal* Piston Burettes will, irrespective of their address, respond to address 99. The 99AA1 command automatically attributes to the individual devices the address from 01 to nn. So it is e.g. possible that addresses starting from 05 are output. In this case all devices will then respond with their new address. If a command is preceded by AB, all the TITRONIC® *universal* Piston Burettes will work off the command and report back automatically. This means that one command can fill all burettes. The corresponding command is: 01ABBF<CR LF>.

Command	Description	Answer
99AAnn	Transmit new address (nn = new address)	nnY
aaABcommand	Command after instruction AB ... is performed and sent to following device	aaY
aaBF	Fill piston burette	aaY
aaBN	Reset ml display to zero	aaY
aaBP	Inquiry of piston position in scale parts	aaBP=0 ... 8000
aaBV	Inquiry of burette volume	aaV=12.34
aaDA13.56	Dose with addition of volume	aaY
aaDO123.4	Dose indicated quantity in ml	aaY
aaDB123.4	Dose quantity in ml without filling and zero	aaY
aaDH	Endless dosing, to be stopped	
aaDZ	Start dosing, without filling; display will add up to max. volume 9999 ml	aaY
aaGDM20,3	Dosing rate in ml/min	aaY
aaGF30	Filling time in s	aaY
aaKA	Which key is being pressed?	AaKey: "Text"
aaKD	Keyboard disable	aaY
aaKE	Keyboard enable	aaY
aaMO0	Inquiry of current function Digit sequence: Z = 1 ⇒ „Titration“ Z = 2 ⇒ „Dosing“ Z = 3 ⇒ „Incremental dosing“	aaModeZ
aaMO1	Set titration function	aaY
aaMO2	Set dosing function	aaY
aaMO3	Set incremental dosing function	aaY
aaRA	Interchangeable unit - inquiry of volume size	aaAUFSATZ:20
aaRH	Identification request	aaIdent:T universal
aaRC	Send last command	aa"last command"
aaRS	Report status	aaStatus:"text"
aaSC	Continue after stop/continue function after stop	aaY
aaSH	Stop, burette stops	aaY
aaSD1..8	Write string in n th matrix line: attach string to be written with "TEXT" (limit characters to 21) as a delimiter character to command e.g.: 01SD11" (Please replace interchangeable unit)	aaY
aaST0	Delete display completely	aaY
aaST1	Switch display fully on	aaY
aaSR	Stop current function	aaY
aaSYS5	Set display language to German	aaY
aaSYS1	Set display language to English -english-	aaY
aaSYS2	Set display language to French -français-	aaY
aaSYS3	Set display language to Spanish -español-	aaY
aaVE	Software version number	aaVersion:99.23
aaVO	Volume inquiry from display	aaV=12.345ml

6 Dosing accuracy

Air bubbles in the system are the main cause of inaccuracy. It is absolutely decisive to keep the cylinder free from air bubbles. The air bubbles are mainly adhering to the piston. The air bubbles can be removed from the piston by knocking, and in the course of the subsequent dosing, or during rinsing, they will escape outwards. Direct sun exposure and temperature fluctuations promote the formation of air bubbles in the cylinder, since there is always (physically dissolved) air in the dosing or titration liquids.

If the system contains air bubbles which cannot be removed easily, one should predose a small volume, e.g. 0.5 ml. Subsequently, use a double click of the grey key of the manual key button to reset the display to zero. The burette is now ready for accurate dosing and titration.

7 Replacing the dosing unit (disassembly and installation)

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

⚠ Caution! Please wear protective glasses! Prior to starting working, screw off the hose from the cylinder! **⚠ Chemicals might leak out!**

The dosing unit is equipped with lateral ribs around its circumference, with one of these ribs being in double design. This double rib serves as a mark for the correct placement of the dosing unit (Fig. 29, item 2, or Fig. 9, item 2).

Important note: The disassembly of the dosing unit as such is only possible using a special tool (TZ 3630) and should only be done by experienced persons. The sealing lip of the PTFE piston and the sealings of the liquid system may be damaged or incorrectly positioned in the course of such a disassembly. As a result, titration liquid would leak in unwanted places.

7.1 Detaching and placement of the dosing unit

⚠ Caution, place a receptable under the titration tip! ⚠

- Press the <FILL/F1> key for five seconds, and keep it depressed until the display shows <<change of the dosing unit>>.
- When the piston moves upwards, titration solution will be dosed out of the burette tip.
- If <<unlock unit !!>> is displayed, the dosing unit has to be unlocked by rotating it by 90° to the left (counter-clockwise Fig. 27).
- Press <START>. The motor of the TITRONIC® universal Piston Burette will now automatically move the dosing unit upwards. After the display shows <<remove unit / set on new unit>> remove the dosing unit (Fig. 28). The process is completed.

Detaching the dosing unit :

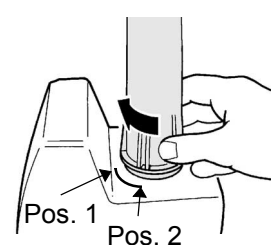
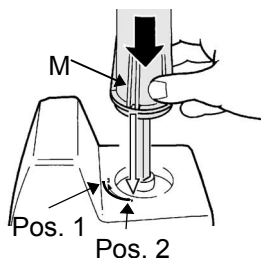
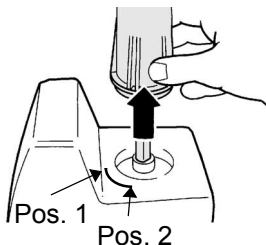
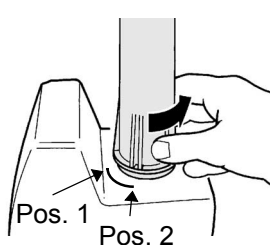
Fig. 27 Unlocking

Fig. 28 Removal


Placement of the dosing unit:

Fig. 29 Placement

Fig. 30 Locking



- Set on new (inspected, if necessary repaired) dosing unit vertically (Fig. 29), then press the <FILL> key. The running motor will now pull the dosing unit downwards, while the display requests to align the unit, „M“ mark to position 2. If any noise should become audible at this point, please stop the process immediately by pressing the <START/STOP> key. The cause of this „rattling noise“ will be eliminated by setting the dosing unit **vertically** on again!

- As soon as the dosing unit moving downwards has reached the edge of the casing, the display requests you to lock the dosing unit manually by rotating it by 90° to the right (clockwise,  Fig. 30).
- After locking it, start the rinsing and initial-filling process using the <FILL/F1> (Rinsing/F1) key.
- Select cylinder of 20 or 50 ml.

The following image will be shown:

Setting cylinder volume	
Cylinder volume:	20 ml
Change digits:	<↑↓>
OK:<F1>	ESC:<F4>

Use the <↑>, <↓> arrow keys to change for the software the cylinder volume from 20 to 50 ml or vice versa. Acknowledge your selection using the <FILL> key, and it will be permanently store in the EEPROM.

Please note:

An incorrect input can only be changed by repeating the entire procedure of replacing the dosing unit! If the input cylinder volume is incorrect, the volume being displayed will not match the one!

7.2 Replacing the titration solution

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

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

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

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

8 Trouble shooting

The device does not respond to keys being pressed, the display is dark.

<i>The internal program is disturbed (e.g. by electrostatic charging or mains overvoltage).</i>	Switch device off, switch it on again after 10 s.
<i>The display contrast is misadjusted.</i>	Use the knurled knob at the right side of the bottom to adjust the contrast.

The stirrer does not work.

<i>The connection contacts are dirty.</i>	Clean contacts.
---	-----------------

The dosing unit is not filled correctly.

<i>The reagent bottle is empty.</i>	Replace or top up reagent bottle.
<i>The hose is not immersed deeply enough in the reagent bottle.</i>	Immerse the hose deeper in the reagent bottle or top up reagents.
<i>The dosing unit is not properly locked.</i>	Latch dosing unit with a quarter rotation in the lower position.

Air bubbles in the system

<i>The valve is defective.</i>	Replace valve.
<i>The hose connections are not tight.</i>	Check: Has the hose been pulled out of the threaded connection? Fasten fingertight. Replace hoses plus screw connectors.
<i>The hose is not immersed deeply enough in the reagent bottle.</i>	Immerse the hose deeper in the reagent bottle or top up reagents.

The titration tip drips after use.

<i>Air bubbles in the system.</i>	Set longer filling time.
-----------------------------------	--------------------------

When installing the dosing unit the piston rod is not pulled in correctly, the device "rattles".

<i>Oblique application of piston rod.</i>	Re-apply the piston rod vertically.
---	-------------------------------------

The titration solution is not titrated/dosed.

<i>The dosing unit is not properly filled</i>	Perform initial filling.
<i>The dosing unit is not properly locked.</i>	Lock dosing unit with a quarter rotation in the lower position (📖 Fig. 30).
<i>The hose or the titration tip are bent or obstructed.</i>	Check proper flow through hose and tip, replace if required.
<i>The system contains air bubbles.</i>	Please refer to "Air bubbles in the dosing system".
<i>Undissolved parts in the titration solution.</i>	Filter or replace titration solution.
<i>Valve hoses are mixed up.</i>	Connect hoses (📖 Fig. 1 + 8).

Data transfer to the printer/computer does not work.

<i>Set proper transfer parameters.</i>	Setting: 4800 baud, 7 data bits, no parity, no handshake.
<i>Using an appropriate cable?</i>	Use TZ 3095 for printer or TZ 3096 / TZ 3097 for PC.
<i>Cable correctly connected?</i>	The middle socket is the RS-232-C interface 1. Check cable connection; are the screws on the side of the PC tightened? PC: Possibly „COM 1“ and „COM 2“ were mixed up!
<i>Defective cable.</i>	Replace cable.
<i>Malfunction of printer/PC or TITRONIC® universal Piston Burette</i>	Switch device off, switch in on again after 10 s.

9 Maintenance and care of the TITRONIC® *universal* Piston Burette

To maintain the proper functioning of the TITRONIC® *universal* Piston Burette, certain inspection and maintenance work has to be carried out.

Maintenance intervals

Normal operation:



- As a principle, all work has to be done at max. intervals of 3 months.

Under special load:


Special load is present, for instance, if solutions are used which are likely to attack glass, e.g. alkaline, fluoride-containing, phosphate-containing solutions, or if more than an average of 40 titrations are performed per day.

- Once per month the dosing unit has to be visually checked for damage.
- Once a year the inspection according to DIN 12 650, Part 6 or Part 7, or to ISO DIS 8655, Part 3, should be carried out, unless internal quality standards provide for different regulations.
- Once per quarter the electrical contacts (plugs, stirrer, manual key button) have to be checked for corrosion if the TITRONIC® *universal* Piston Burette is used in rooms the atmosphere of which occasionally contains corrosive matters.
- If there is a suspicion that a solution attacks the glass cylinder particularly seriously, the maintenance intervals are to be shortened correspondingly.

In the case of disturbances:

- If any disturbance, malfunction, or another defect becomes obvious, maintenance work is required immediately.
- If one has to assume that  safe operation is impossible , please observe chapter, "Warning and safety information".

Maintenance work to be performed

- Check whether there is moisture below the dosing unit. To do so, remove the dosing unit ("Detaching and placement of the dosing unit" chapter Fig. 27 to 30). If moisture is actually present, one can conclude that the piston in the cylinder is no longer tight.
- Check the hoses, screwed connections, and seals for visible damage, contamination and leakage, assembly of the screwed connections  detailed sketch of Fig. 31.
- Check the electrical plug connections for corrosion and physical damage.
- Defective parts have to be repaired or replaced by new parts. Defective glass parts have to be replaced in each case.

After each maintenance work a test of the metrological reliability according to DIN 12 650, Part 6 or 7, or to ISO DIS 8655, Part 3 is required.

The test of the metrological reliability -including maintenance work- is offered as a SCHOTT-GERÄTE service (including manufacturer's test certificate, if required). For this purpose the TITRONIC® *universal* Piston Burette has to be sent to SCHOTT-GERÄTE.

Interruptions of use

- If the TITRONIC® *universal* Piston Burette is not used for more than one week, the liquids contained in the system should be removed, and the TITRONIC® *universal* Piston Burette is to be rinsed with distilled water. If this is omitted the piston may be destroyed, and the TITRONIC® *universal* Piston Burette will become untight. In addition, if the liquid is left within the system, one has to reckon with the occurrence of corrosion and with a modification of the solutions used over time. Considering that state-of-the-art technology does not offer plastic hoses which are totally free of diffusion for use with the TITRONIC® *universal* Piston Burette, special attention should be paid to the hose range.

Cleaning

- The TITRONIC® *universal* Piston Burette should be cleaned using a damp cloth and normal household cleaning agents.
- The bottom and the rear panel have to be treated dry. In no case must liquid penetrate into the interior of the TITRONIC® *universal* Piston Burette.

10 Storage, transportation and environment

If the TITRONIC® *universal* Piston Burette has to be stored temporarily or transported, the original packing will provide the best protection for the device. In many case, however, this packing is no longer available, so that a comparable makeshift packing has to be put together. Sealing the TITRONIC® *universal* Piston Burette in a foil has proven to be a good solution.

**Before doing so, please make sure
that the dosing unit has been rinsed with distilled water
and contains no liquid.**

If the TITRONIC® *universal* Piston Burette has to be sent in for repair, please state the titration solution last used on the accompanying papers or on the TITRONIC® *universal* Piston Burette itself. Otherwise the service department will dispose of the damaged or replaced parts as special waste on the customer's account.

The device should be stored in a room meeting the following requirements:

- ☛ temperature between + 10 and + 40 °C for operation and storage,
- ☛ humidity according to EN 61 010, Part 1:
max. ref. humidity 80 % for temperatures up to 31 °C,
linear decrease down to 50 % relative humidity at a temperature of 40 °C

Your TITRONIC® *universal* Piston Burette will have a very long life,
so that this information is in fact given far too early:

But when the end of its lifetime has come, please observe the regulations of your country and town regarding disposal.

11 Accessories and spare parts

Accessories

- TZ 1509 bottle set for titration agents
 TZ 2008 bottle set-on unit with S 40 thread for reagent bottles, e.g. Merck make
 TZ 2005 bottle set-on unit with GL 45 thread for reagent bottles, e.g. Riedel-de Haën, Schott make
 TZ 3025 TM 96 Stirrer with PTFE stirring rod
 TZ 3094 1.0 m data cable RS-232-C: TITRONIC® *universal* Piston Burette →
 TITRONIC® *universal* Piston Burette –daisy chain concept–
 1. side and 2. side: 4-channel mini DIN plug
 TZ 3095 1.5 m data cable RS-232-C with plug for printer connection:
 1. side: 4-channel mini DIN plug
 2. side: 25-channel sub-Miniature-D plug
 TZ 3096 1.5 m data cable RS-232-C for computer (PC) with 25-channel plug:
 1. side: 4-channel mini DIN plug
 2. side: 25-channel sub-Miniature-D plug
 TZ 3097 1.5 m data cable RS-232-C for computer (PC) with 9-channel plug:
 1. side: 4-channel mini DIN plug
 2. side: 9-channel sub-Miniature socket
 TZ 3098 data cable set:
 1.5 m data cable RS-232-C: 1. side: 4-channel mini DIN plug
 2. side: 9-channel sub-Miniature-D socket
 Adapter: 9-channel plug → 25-channel socket
 TZ 3460 printer with RS-232-C interface, including 1.5 m TZ 3095 printer cable

Spare parts

TITRONIC® *universal* Piston Burette

- TZ 1503 burette tip
 TZ 3000 valve
 TZ 3280 hose set
 TZ 3630 mounting wrench
 TZ 3660 electrode / titration-tip holder
 TZ 3665 stand rod
 TZ 3680 manual key button

TITRONIC® *universal* Piston Burette / 20 ml

- TZ 3130 dosing unit 20 ml, complete assembly

TITRONIC® *universal* Piston Burette / 50 ml

- TZ 3160 dosing unit 50 ml, complete assembly

Order numbers

Fig. 31

