

METROHM Ltd. CH-9101 Herisau (Switzerland)

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**Dosimat**

**715**

Series 10 ...

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8.715.1023

96.04 Ti

# Instructions for use

## 715 Dosimat

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**Explanation of symbols:**

< >

means "key", e.g. <GO> means key "GO"



means "display"

# 1. Operating elements and their function

## 1 Exchange unit

Only models with flat cock.

Note:

- With some exchange units it is possible that the mechanism of the cock changeover is springy and you can hear a ticking noise. Press the changeover lever to the right side. Do not turn cock with Dosimat switched off!

## 2 Display

The 16 digit display shows all important information:

<u>DOS</u> 3.456 ml	DOS = dosing and dosed volume. Dosimat is in stand-by position.
<u>DOS</u> ↑ 3.456 ml	as above, but with Dosimat busy; piston is moving upwards.
<u>DOS</u> ↓ 3.456 ml	as above; but piston is moving downwards.
<u>DOS</u> → 3.456 ml	Cock turns to the right side.
<u>DOS</u> ← 3.456 ml	Cock turns to the left side.

Displayed ↑ or ↓ resp., are specially important for very slow dosings where movements of the piston can not be clearly identified.

## 3 Operating keys

FILL: Filling.

CLEAR: Resetting of the volume display to 0.000 ml (with Dosimat in stand-by position).

GO: Dosing goes on as long as <GO> is pressed.

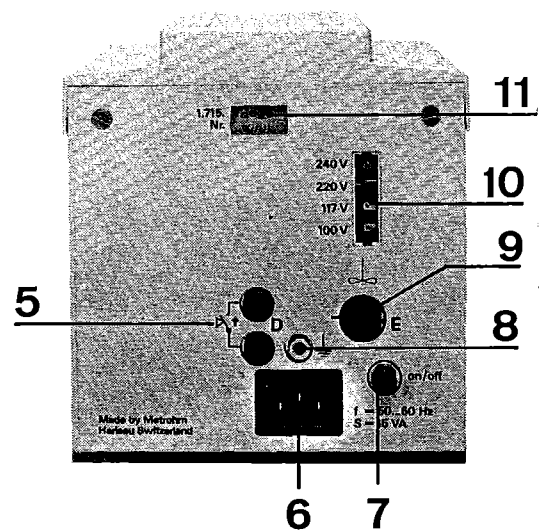
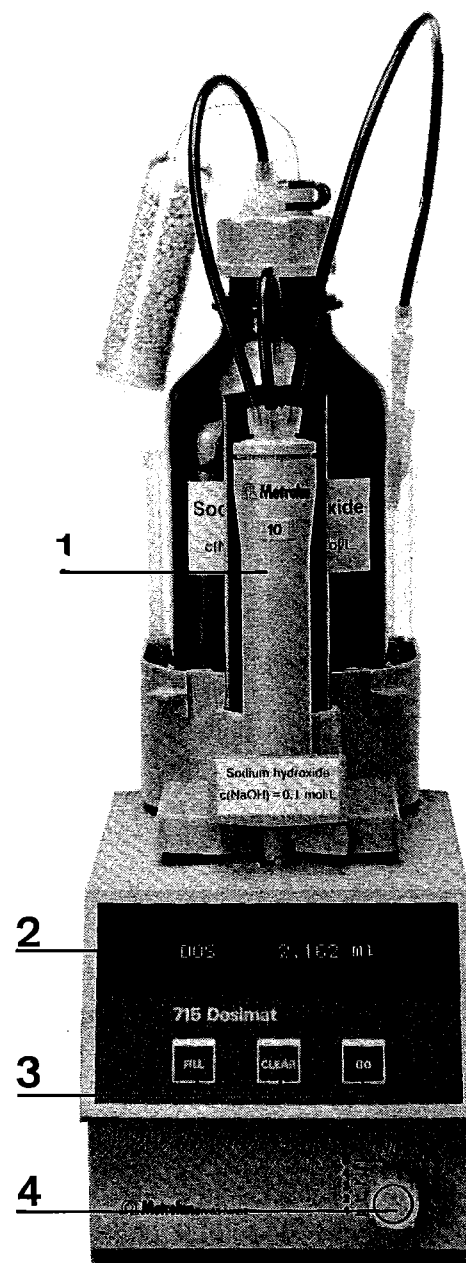
## 4 Analogue setting of dosing and filling rate

Position 1 = lowest rate

Position 10 = highest rate

Filling rate:

If you wish to have the filling rate fixed to maximum speed, have your 715 Doismat changed by the Metrohm Service (the bridge P10 on the 3.715.0091 printed circuit has to be removed).



- 5** **Connection for external dosing contact**  
E.g. 6.2107.000 push button cable or 6.2107.010 foot switch.
- 6** **Mains connection**  
In power supply systems, in which strong HF interferences (transients) are superimposed on the mains voltage, the 715 Dosimat should be connected via an additional powerline filter, e.g. METROHM 615 model.
- 7** **Main switch**  
Switching on and off 715 Dosimat.
- 8** **Earthing socket**  
The 715 Dosimat must be grounded effectively, if necessary through the separate earthing socket.
- 9** **Connection for stirrer**  
Magnetic Stirrer, Rod Stirrer, or Ti Stand.  
Supply voltage output: +9 V DC ( $I \leq 200$  mA)
- 10** **Indication of mains voltage**
- 11** **Identification plate**  
Indication of model, series and serial number.

## 2. Error messages, troubleshooting

### 2.1. Special messages and error messages

Error messages are displayed as soon as the error is recognised by the instrument.

#### General disturbances:

Display remains black.

Execute diagnosis. If this is not possible, call METROHM Service.

The following list of error messages is alphabetical:

error 1	Check sum error in PROM.	} Call METROHM service
error 2	RAM-check: error in on-chip-RAM.	
error 3	RAM-check: error in off-chip-RAM.	
error 4	RAM-check: error in on- and off-chip-RAM.	
error 5	Check sum error in off-chip-RAM. Exit:RAM has to be re-initialised. Switch Dosimat off. Press <FILL> during switching it on again. Display shows /RAM init. / . Press <GO> . Display shows /RAM init. passed/ . <CLEAR> leads to basic programme see also page 9.	
no exch. unit!	Exchange unit is not (properly) mounted. Exit: Mount exchange unit properly.	

## 2. Error messages, troubleshooting

### 2.1. Special messages and error messages

Error messages are displayed as soon as the error is recognised by the instrument.

#### General disturbances:

Display remains black.

Turn cock forward and back twice. If this does not help, execute diagnosis. If this is not possible, call METROHM Service.

Dosing is not possible. No error message in display.

Turn cock forward and back.

The following list of error messages is alphabetical:

error 1

Check sum error in PROM.

error 2

RAM-check: error in on-chip-RAM.

error 3

RAM-check: error in off-chip-RAM.

error 4

RAM-check: error in on- and off-chip-RAM.

error 5

Check sum error in off-chip-RAM.  
Exit:RAM has to be re-initialised. Switch Dosimat off. Press <FILL> during switching it on again. Display shows RAM init.. Press <GO> . Display shows RAM init. passed. <CLEAR> leads to basic programme see also page 9.

no exch. unit!

Exchange unit is not (properly) mounted.  
Exit: Mount exchange unit properly.

} Call  
METROHM  
service

## 2.2. Diagnosis

The 715 Dosimat is an extremely precise feeding instrument of high performance and reliability. Its solid construction hardly allows its functions to be impaired by any external mechanical or electrical influence.

It can never be fully excluded that a fault occurs inside the unit, however, the chance is greater that possible troubles are due to improper operation or handling and/or incorrect interconnections.

In all cases it is advisable to localize faults by means of these diagnosis instructions which are easy to follow and carry out. The customer thus only needs to call for factory service if a fault is found in the unit. Moreover the numbered diagnosis steps allow the customer to give more precise information about the nature of the fault.

For inquiries to Metrohm always advise the serial number of the instrument. If displayed, also state the fault indication.

### Procedure

- Carry out the test steps in order and check whether the Dosimat responds as described. If this is the case, carry out the next step.
- If the instrument does not respond as expected repeat the corresponding diagnosis step in order to exclude possible handling error. If the instrument's response differs from what it should be, the instrument is likely to be defective.
- The diagnosis steps denoted by a triangle ➤ can be used as re-entry points for repetitions
- A fault in the control system can cause the burette drive to be jammed in the upper or lower end position of the cylinder. In case of jamming at the upper end and generally when the drive is blocked, the exchange unit cannot be removed. In this situation proceed as follows:

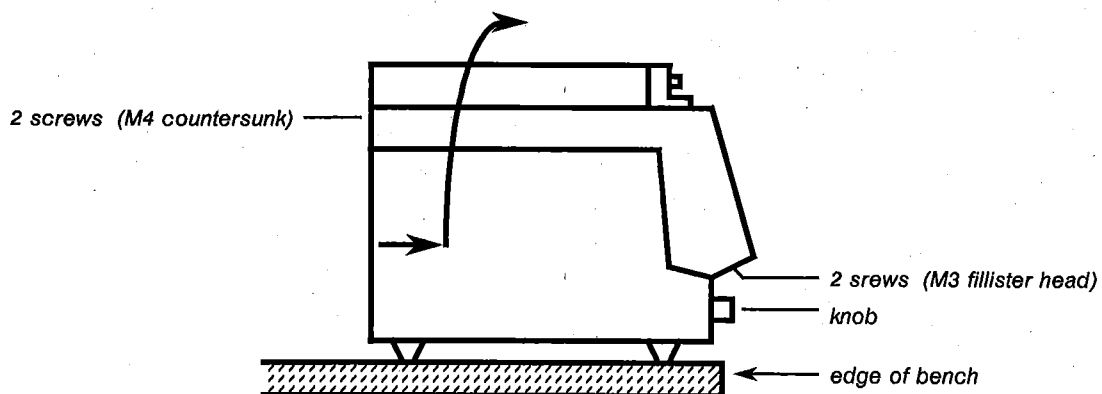


Fig. 1

- Disconnect power plug!
- Remove knob
- Slide the unit to the edge of bench, so that the M3 screws can be removed (Fig. 1)
- Undo M4 screws
- Lift upper part of unit together with exchange unit by movements as shown in Fig. 1.

**Caution: The electronic circuits are now uncovered!! Do not touch them!!**

**Equipment required:**

Exchange units if possible with different cylinder volumes

Stop watch or watch with second hand

Push-button cable 6.2107.000 (EA 858) or ordinary test lead with 4 mm banana plugs.

**1. Preparation**

1.1 Disconnect external connections and stirrer  
Connect push-button cable (if available)

1.2 If no exchange unit is inserted:  
Insert any exchange unit.  
Install burette tip in order to feed back to the bottle (instead of drying tube).

1.3 Power ON and wait until switch-on test pattern disappears.

1.4 Cock turns to "fill" position

Spindle runs fully to the bottom

Spindle slowly runs upwards for 1 mm and stops.

Cock turns to "feed" position

**DOS 0.000 ml**

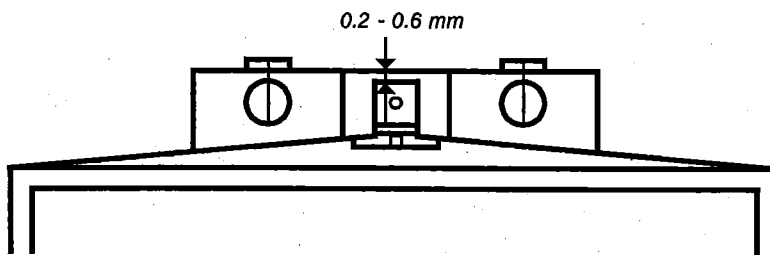
*Since the quoted events run down in a very short time, it can possibly be required to repeat this item several times. When repeating proceed as follows:  
Press <GO> and allow the spindle to move upwards for some mm. Then actuate <FILL>.*

1.5 Remove exchange unit

**no exch. unit!**

➤ 2. Diagnosis of spindle drive

2.1 To check the spindle zero



The spindle must be 0.2 - 0.6 mm below the edge of the mounting plate.

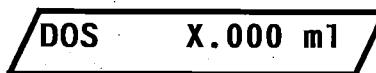
2.2 Check feeding time with max. speed

Insert exchange unit again

Dosimat fills

Turn knob 'dV/dt' fully to the right

Press feed button 6.2107.000 (if not available, <GO>) all the time until the piston rod reaches the top position and simultaneously measure the time from start to stop.



X corresponds to the exchange unit

The running time of the spindle is 20 s ( $\pm 5$  s)

Dosimat fills (automatically).

2.3 Measure the filling time (turn knob 'dV/dt' fully to the right)

Repeat point 2.2 and now measure the filling time until the spindle stops at the lower end

The running time (filling time) of the spindle is 20 s ( $\pm 5$  s)

(Spindle slowly runs upwards for 1 mm and stops; cock turns to position 'feed')

The display is not set to 0000

Depress <CLEAR>: Display sets to 0.000 ml.

2.4 Check feeding time with min. speed

Turn knob 'dV/dt' fully to the left

Press feed button (or <GO>) all the time and simultaneously measure the time, until, depending on the exchange unit, the volume in the table below is reached.

1 ml:	0.02 ml
5 ml:	0.1 ml
10 ml:	0.2 ml
20 ml:	0.4 ml
50 ml:	1 ml

The running time of the spindle is 19 s ( $\pm 5$  s)

Carry out filling procedure

**Caution:** *If the unit does not perform filling at maximum rate but at a rate which is equal to the dosing rate, this means that the unit is set internally to analogue filling rate (see page 2, item 4, jumper P 10 at connectors P 9 removed).*

## 2.5 Measure the spindle height

*Need be carried out only if the spindle drive is supposed to be affected.*

Remove exchange unit

Turn knob 'dV/dt' fully to the right

Carefully actuate the locking switch by inserting a screw driver into the guide hole on the right-hand side of the slide plate and keep the switch actuated. Dosimat fills.

Press <GO> and keep pressed, then remove the screw driver

The spindle moves to the top and stops

The spindle moves 80 mm with respect to spindle zero (see drawing 2.1). (The travel of the spindle may be measured e.g. by means of the depth gauge of a sliding caliper)

*Instead of the spindle height one can also measure the expelled volume (corresponding to the max. vol. of exchange unit).*

Again actuate the locking switch briefly

Dosimat fills

Insert exchange unit again

Dosimat fills.

## End of the test

Insert stirrer again.

Test stirrer function.

Most of the functions of the 715 Dosimat are examined with the above diagnosis steps. However, in case of suspicion that data stored in the Dosimat might get lost although the automatic 'RAM test' at power on did not reveal any fault, the endless 'RAM test' can be carried out additionally (see item 3).

## ➤ 3. Endless-RAM-test (non-destructive)

3.1 Power off (wait 5 s)

3.2 Power on and simultaneously press <CLEAR> until the display shows 'RAM test'.

3.3 <GO>

**RAM test !**

The processor now checks the ON-chip-RAM and the OFF-chip-RAM of the 715 Dosimat, without affecting the RAM content. The exclamation (!) appears when the test is positive. The test can be continued at will. In case of negative test, the following fault indications may be displayed:

"E02: on-chip RAM": fault in ON-chip-Memory  
"E03: off-chip RAM": fault in OFF-chip-Memory  
"E04: both RAM s": fault in both Memorys

3.4 The test is broken off with <CLEAR> (Depress the key only until the dotted pattern appears!)

DOS 0.000 ml

Dosimat fills.

**Caution:** Never leave the endless-RAM-test with 'Power off' but with <CLEAR>!

» 4. **RAM initialization**

It can happen that the initialization data of the RAM get lost, namely if the power is turned off erroneously during the RAM test (item 3) or if repairs on the circuitry are carried out. This is indicated after 'power on' with 'error 5'. These data can be entered with the aid of the RAM initialization.

**How to proceed**

4.1 Power off (wait 5 s )  
(all ext. connections removed!)

4.2 Power on and simultaneously press key 'Fill' until the dotted pattern disappears on the display.

RAM init.

4.3 <GO>

RAM init. passed

4.4 <CLEAR>

DOS 0.000 ml

Dosimat fills

The Memory is loaded with the standard parameters.

5. **List of errors**

E02...E04: see endless RAM test.

### 3. Exchange Units

Exchange Units are available with light protection, in brown, or clear glass. The versions with light protection or in amber glass should be used for light-sensitive reagents (silver nitrate, Karl Fischer, etc.)

**Accuracy data:**

Burette volume $V_{bur}$ (in ml)	Abs. error rel. to nominal volume $\pm \Delta V$ (in ml)	Reproducibility error accuracy $\pm \Delta V$ (in ml)	Resolution of the display $\Delta V$ (in ml)
1.000	0.003	0.001	0.001
5.000	0.015	0.005	0.001
10.000	0.02	0.005	0.001
20.000	0.03	0.01	0.002
50.000	0.05	0.04	0.005

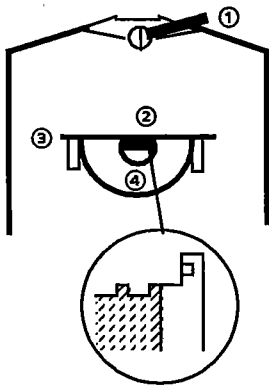
**Note:**

In gravimetric checks of the dispensed volume, the air buoyancy (app. 0.1%) in the weighing must be taken into account. Consideration should also be given to evaporation.

Different models are available. A survey is given in the table below:

Model	Available Burette Cylinders	Cock	Burette Tip
<b>6.3014.XXX</b>	1, 5, 10, 20, 50 ml With light protection and optional thermostatic jacket.	PCTFE/PTFE.	Anti-diffusion and normal.
<b>6.3013.XXX</b>	1, 5, 10, 20, 50 ml With light protection and optional thermostatic jacket.	Ceramic.	Anti-diffusion and normal.
<b>6.3012.XXX</b>	5, 10, 20 ml With light protection and optional thermostatic jacket.	Ceramic.	Anti-diffusion.
<b>6.3011.253</b>	50 ml With light protection and optional thermostatic jacket.	Ceramic.	Normal.
<b>6.3007.XXX</b>	5, 10, 20 ml Brown and clear glass.	PTFE.	Anti-diffusion.
<b>6.3006.XXX</b>	1, 5, 10, 20, 50 ml Brown and clear glass.	PTFE.	Normal.

### 3.1 Setting up 6.3011.XXX...6.3014.XXX Exchange Units



Before plugging-in the Exchange Unit, check if the stopcock turn lever ① is to the right and if the coupling ② stands parallel to the ridge ③ and is even with the rings ④. The coupling can be adjusted with the 6.2739.010 key.

- Remove packaging plate from under the reagent bottle
- Mount retaining clips for the reagent bottle, see Fig. 3-5, page 15.

Fig. 3-1: Bottom view

If you do not wish to use the reagent bottle supplied, convert your Exchange Unit as follows:

- Snap in the reagent bottle retaining clips so that the reagent bottle sits snugly in the Exchange Unit.
- For different original reagent bottles, you need a special bottle siphon and possibly also a threaded adapter. The following bottle siphons are available:
 

for bottles with GL45 thread, e.g. Riedel-de Haën (1 L), Baker (bottle siphon included in standard equipment)	6.1602.100
for bottles with S40, e.g. Merck	6.1602.110
for bottles with 32 mm thread, e.g. Fluka, Riedel-de Haën (500 ml)	6.1602.100 + 6.1618.000
for bottles with 28 mm thread, e.g. Fisher	6.1602.100 + 6.1618.010
- Screw the appropriate bottle siphon onto the reagent bottle.
- If necessary, replace the 6.1602.100 Bottle Siphon with the combination you need.

The holder on the right serves to hold the burette tip; in the holder on the left you can store the electrode associated with the reagent, for example.

### 3.2 Assembly of models 6.3006.XXX / 6.3007.XXX

See also Fig. 3-7, page 17.

- The instrument without Exchange Unit is in the zero position.
- Mount Exchange Unit (without glass cylinder) from the front on the sliding plate and push right back.
- Allow piston spindle to run out by app. 2 cm.
- Carefully grease PTFE piston (see Section 3.5), assemble coupling and carefully slide glass cylinder over it from above ensuring exact axial alignment. (If the PTFE piston slips out of the coupling, the 6.1546.010 Piston Rod can be used to shift the piston in the glass cylinder.)
- Center cylinder flange in the slot of the exchange support.
- Clamp cylinder with 6.2035.000 Flange and 6.1549.000 Clamping Ring moderately tightly. (For 50 ml units, use 6.1551.000 Plastic Flange.)
- Fit remaining components of Exchange Unit.
  - . Tubing connections:

Models 6.3006.XXX/6.3007.XXX

Flat cock

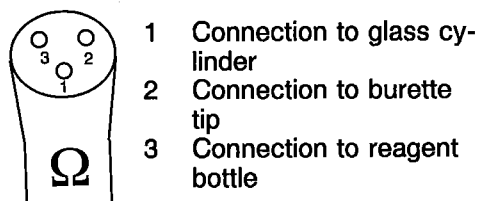


Fig. 3-2: Stopcock tubing connections

- . Tighten screw nipples manually. Nipples should be tightened with the 6.2739.000 Key only at inaccessible locations and not too tightly (tightening force app. 100 p ≈ 1 N with 5 cm key). The tubing must not be pinched.
- Allow piston to run in zero position.

### 3.3 Filling for the first time

- Fill reagent bottle with titrant.
- Insert cotton wool in the drying tube and add a suitable adsorbent. Cover with cotton wool and close with cover.
- Press <GO> key until the piston is in the top end position.
- Press <FILL> key.

Repeat filling process in both directions until the glass cylinder together with the connections up to the burette tip is filled. Hold burette tip up and allow air bubbles to escape. Experience has shown that small air bubbles do not cause any disturbance as they remain attached to the wall even when the piston moves quickly.

### 3.4 Exchanging Unit

When the Exchange Unit is mounted or removed, the burette must be in the zero position (filled + drive play taken up), otherwise the exchange support will be mechanically arrested by the piston spindle.

All Exchange Units are adjusted such that the spindle is even with the sliding plate when in the zero position thereby ensuring universal interchangeability.

If an Exchange Unit can not be mounted, the coupling of the PTFE piston must be adjusted with the aid of the 6.2739.010 Key in the case of the 6.3011.XXX...6.3014.XXX models or with the 6.1546.010 Piston Rod with the other models.

**Caution:** If no liquid is aspirated into the glass cylinder of the Exchange Unit upon filling – despite a filled reagent bottle and correct tubing connections – the cylinder can be under vacuum. In this case, it may be dangerous to remove the Exchange Unit (the cylinder may break). Aerate the cylinder by opening the tubing connection at the head of the cylinder.

### 3.5 Maintenance

It is best to store burette tips in the same solvent as the titrating agent to prevent crystallisation of the reagent: Fill glass holder with solvent, pass burette tip through the ball stopper and place it in the glass holder. In case of KF reagent: Store burette tip in methanol. Warning: Before dispensing check that the burette tip is not blocked!

Emptying and cleaning:

- Discharge as much titrant as possible.
- Burette in the zero position, disconnect connections to bottle and burette tip.
- Remove light protection.
- Undo attachment of the glass cylinder and let spindle run out until the piston can be disengaged.
- Completely empty cylinder with the aid of the 6.2739.010 Key or 6.1546.010 Piston Rod and carefully pull out piston.
- Rinse and clean individual parts properly. (Take special care to ensure that no reagent remains in the threaded hole of the PTFE tubing connections.)

#### PTFE piston

The PTFE piston must be handled with care to avoid damaging the lip seals. Residual grease should be wiped off with a soft, lint-free cloth. Carefully apply fresh grease with your finger to the lip seals and in the spaces. Wipe off leading edge to ensure that the reagent does not come into contact with the grease. When inserting the piston in the glass cylinder, ensure that it is introduced without cogging.

SISCO 3000 (Swedish Iron & Steel Corp.) grease - this is not a silicon grease (!), the name refers to the manufacturer - has well proved its worth since our tests have shown that it is not only inert to all titrants in normal use but also has a favourable viscosity.

A worn piston must be replaced immediately to prevent titrant leaking out and corroding the drive spindle.

## Flat cock

The stopcock needs no maintenance. If a defect is suspected, it is best to return it for checking to the manufacturer unopened (improper handling can render the stopcock completely useless). It is thus advisable to always keep a 6.1542.0X0 Stopcock as a spare.

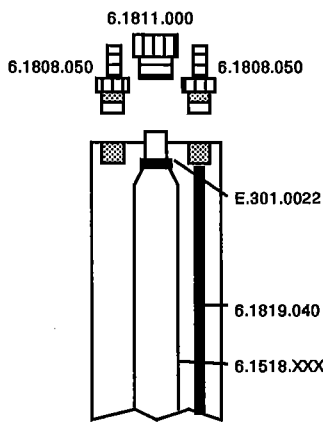
### Removing stopcock:

- Switch lever to "↑" ≙ dispensing.
- Unscrew nipples of the tubing connections.
- Pull out 6.1542.0X0 Stopcock upwards (pull hard!).

### Refitting:

- Switch lever to "↑" ≙ dispensing.
- For PTFE stopcock: Align markings on shaft and housing of stopcock.
- Insert stopcock from above in the holder and press down until the quick-release coupling engages.
- Screw in screw nipples.

## 3.6 Mounting the thermostat jacket of 6.3011.XXX...6.3014.XXX Exchange Units



1. Undo tubing connection of 6.1518.XXX Glass Cylinder.
2. Remove light protection.
3. Unscrew 6.1811.000 Screw Fitting at glass fitting.
4. Roll O-ring upwards out of groove on glass fitting. Do not use any hard objects to remove the O-ring, otherwise the edge of the glass fitting can splinter! If all else fails, cut O-ring. Ordering number for new O-ring: E.301.0022.
5. Grease 1536.010 Thermostat Jacket slightly at its lower inner end and mount it.
6. Grease O-ring slightly and mount it onto the glass fitting.
7. Attach upper part of 6.1811.000 Screw Fitting to glass fitting.
8. Make connection to stopcock.
9. Insert 6.1819.040 PTFE Tubing in thermostat jacket and attach thermostat tubing using 6.1808.050 Coupling.

Fig 3-3: Thermostat jacket

### 3.7 6.3006.113 Micro-model – 1 ml

#### Assembly:

See also Fig. 3-8, page 18.

- The instrument without Exchange Unit is in the zero position.
- Mount Exchange Unit (without glass cylinder) from the front on the sliding plate and push right back.
- Allow piston spindle to run out by app. 2 cm.
- Screw 6.3022.113.
- Join coupling of Exchange Unit to piston rod and reset instrument to zero position.
- Fix 6.1548.010 Adapter Flange by means of 6.2035.000 Metal Flange and V.911.0040 Knurled Nuts.
- Turn glass cylinder so that the bending comes against the handle.
- Fit remaining components of Exchange Unit.
  - . Tubing connections:

Flat cock

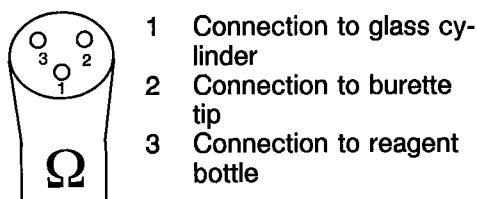


Fig. 3-4: Stopcock tubing connections

- . Tighten screw nipples manually. Nipples should be tightened with the 6.2739.000 Key only at inaccessible locations and not too tightly (take care not to squeeze the tubing).  
**Caution:** Solid material will clog capillary tubing! Don't pull at the tubing!
- Allow piston to run in zero position.

#### Filling:

- Fill reagent bottle with titrant.
- Insert cotton wool in the drying tube and add a suitable adsorbent. Cover with cotton wool and close with cover.
- Press <GO> key until the piston is in the top end position.
- Press <FILL> key.

Repeat filling process in both directions until the glass cylinder together with the connections up to the burette tip is filled. Drive air bubbles in the glass cylinder upwards with tapping. If the air bubbles don't move, take Exchange Unit to pieces, degrease glass cylinder thoroughly and dry it afterwards.

#### Cleaning:

- Undo connection to reagent bottle, repeat expelling and filling to empty glass cylinder.
- Undo connection to glass cylinder.
- Remove Exchange Unit from instrument.
- Unscrew knurled nuts and remove glass cylinder with adapter flange.
- Separate exchange set from adapter flange and take everything apart.
- Carefully clean and dry individual parts (take care that no reagent remains in the tapped hole of PTFE tubing connections).
- Change 6.2712.000 seal if necessary (oval part upwards).

### 3.8 Ordering designations

#### 3.8.1 Standard accessories

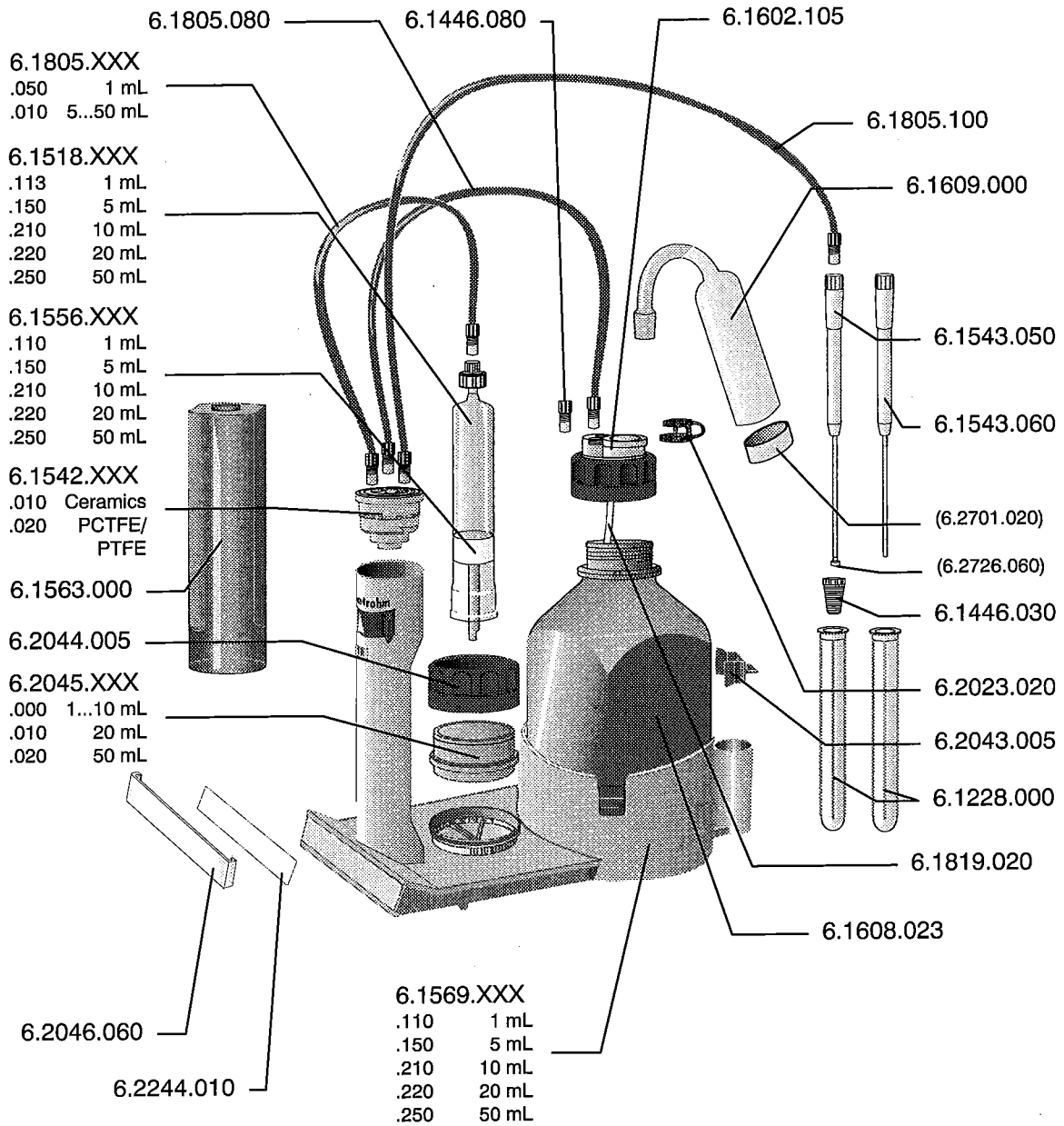


Fig. 3-5: Standard accessories and ordering designations for 6.3013.XXX and 6.3014.XXX Exchange Units

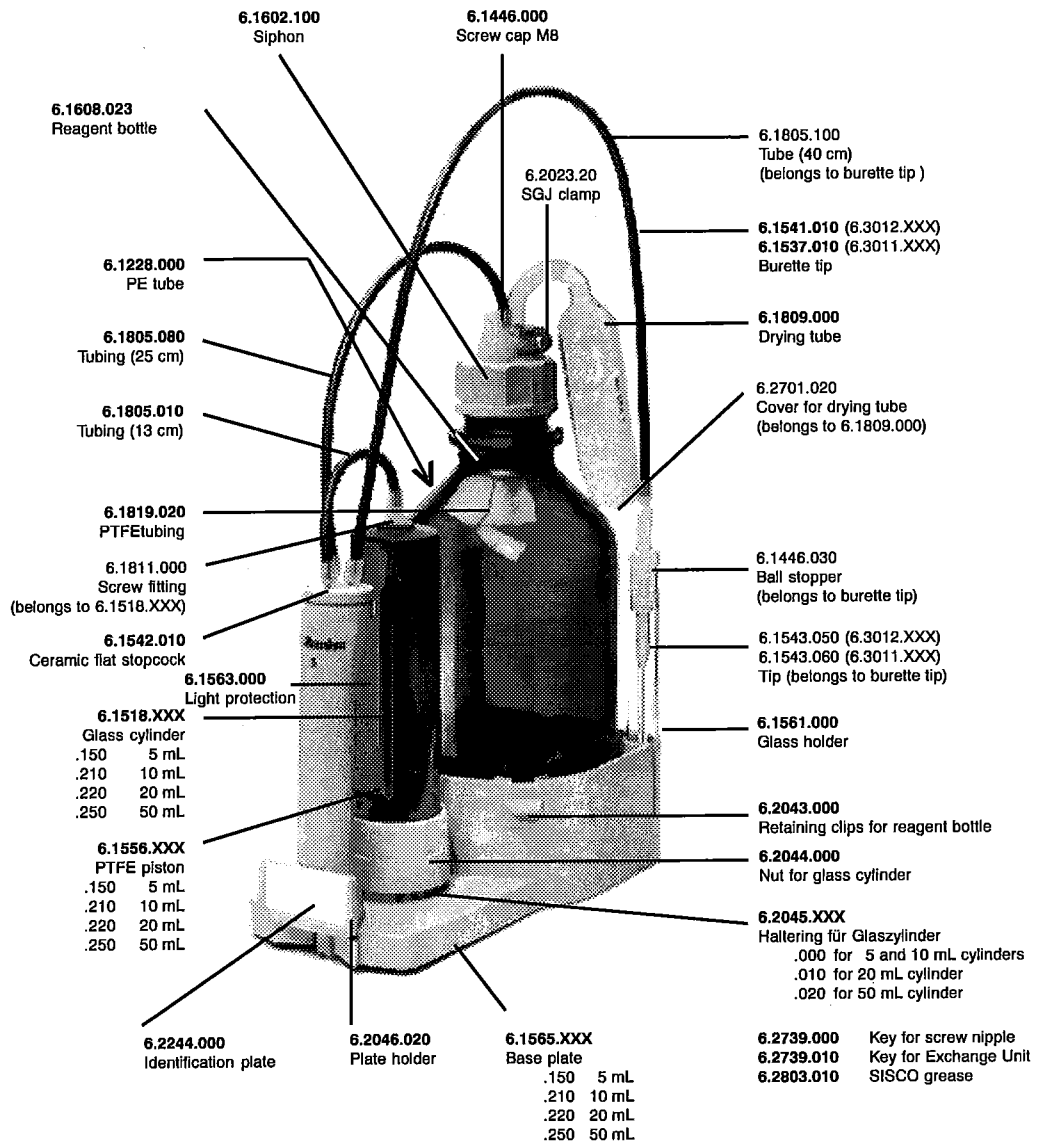


Fig. 3-6: Standard accessories and ordering designations for 6.3011.XXX and 6.3012.XXX Exchange Units

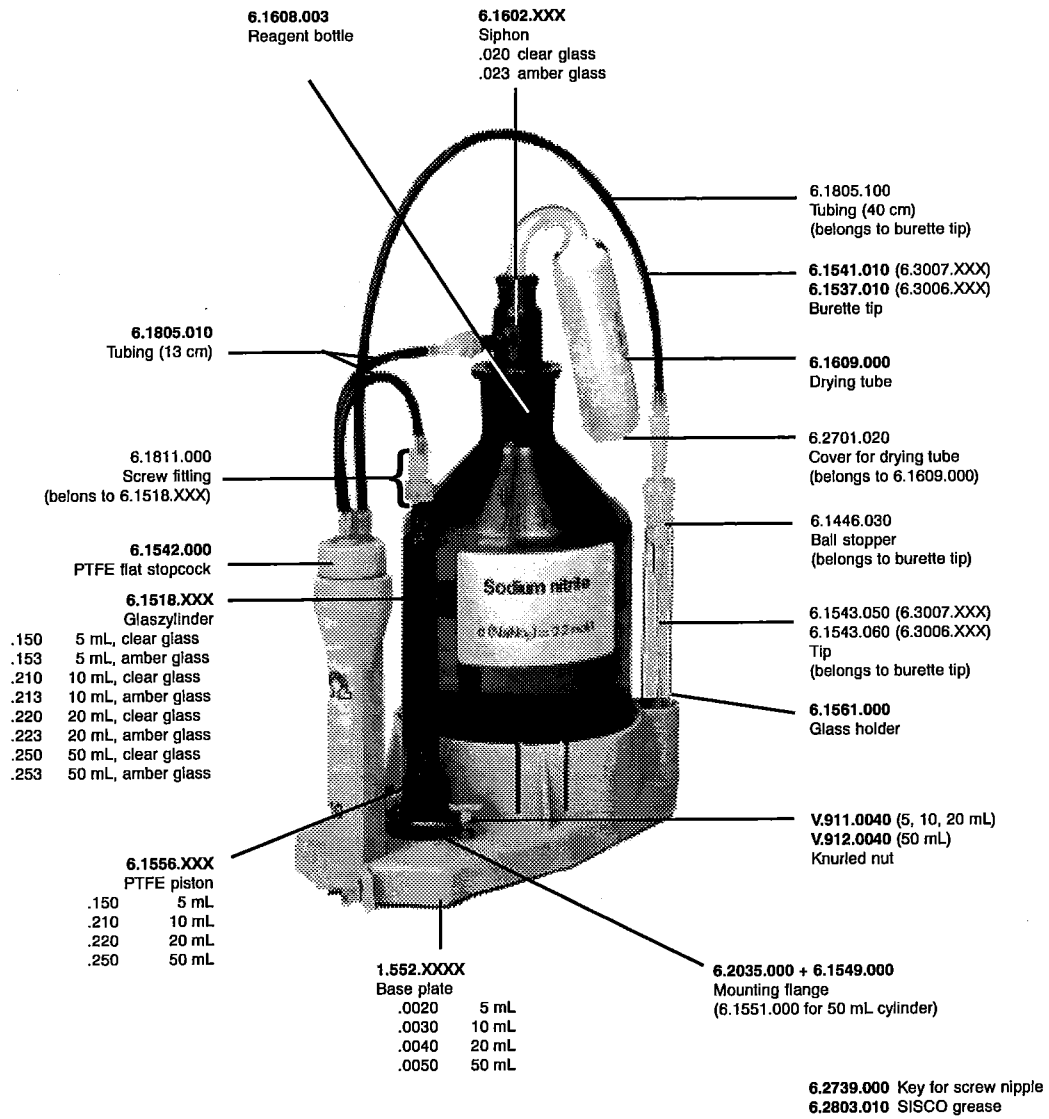


Fig. 3-7: Standard accessories and ordering designations for 6.3007.XXX and 6.3006.XXX Exchange Units

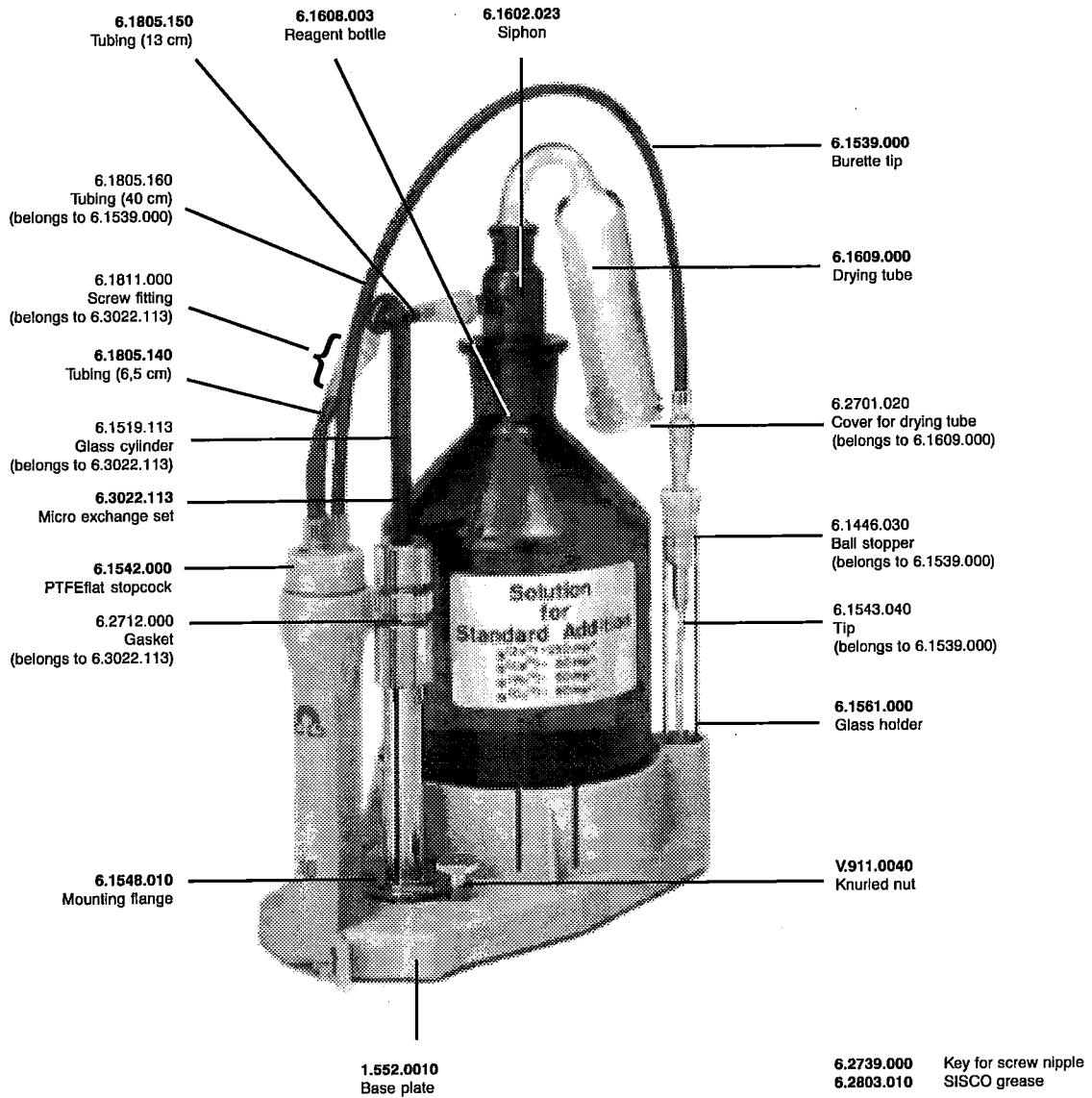


Fig. 3-8: Standard accessories and ordering designations for 6.3006.113 Exchange Unit

### 3.8.2 Options for exchange units

#### Bottles and accessories:

Siphon with GL 45 thread (bottles from Riedel de Haën, ...)	6.1602.120
Siphon with S40 thread (bottles from Merck ...)	6.1602.130
Thread adapter 32 mm/GL 45	6.1618.000
Thread adapter 28 mm/GL 45	6.1618.010
Amber glass bottle, 1L, with GL 45 thread	6.1608.023
Glass bottle, 1L, with GL 45 thread	6.1608.030
PE bottle, 1L, with GL 45 thread	6.1608.040
Bottle made of PP, 1L, with ground-glass joint SGJ 29	6.1608.004
Siphon for bottles with SGJ 29	6.1602.023
Glass bottle, 100 mL, with GL 45 thread	6.1608.050
Holder for 100 mL flasks	6.2055.000

#### Tubing and accessories:

The standard screw fitting of the Exchange Units has M6 thread size. On change to M8 thread, the 6.1808.040 Thread Adapter is needed.

Extension tubing with screw nipples, M6 thread	
Length 80 cm	6.1805.110
Length 150 cm	6.1805.030
additional lengths, see Accessories catalogue	
Extension tubing with screw nipples, M8 thread	
Length 50 cm	6.1805.200
Length 25 cm	6.1805.210
Connecting sleeve for tubing extensions (tubing with M6 thread)	6.1808.000
T-connection for tubing with M6 thread	6.1808.060
T-connection for tubing with M8 thread	6.1808.070
Coupling with M6 thread and stub for tubing with internal diameter app. 3 mm	6.1808.020
Coupling with M8 thread and stub for tubing with internal diameter app. 3 mm	6.1808.050
Screw cap, seals tubing with M6 thread together with 6.1808.000 Connecting Sleeve	6.1446.040
Screw fitting for glass cylinder and tubing with M6 thread	6.1811.000
Screw fitting for glass cylinder and tubing with M8 thread	6.1811.010

#### Tubing connections with larger internal diameter and M8 thread at Exchange Unit:

For the connection bottle-stopcock:

Stopper, M6 thread	6.1446.040
PTFE tubing	6.1819.030
Tubing with screw nipples, 25 cm, M8 thread	6.1805.210
Thread adapter with M6 outer thread, M8 inner thread	6.1808.040
For the connection stopcock-tip:	
Thread adapter with M6 outer thread, M8 inner thread	6.1808.040
Tubing with screw nipples, 50 cm, M8 thread	6.1805.200
Tip, M8 thread	6.1543.120

#### Burette tips:

Earthing for burette tip	6.1808.030
Tip without anti-diffusion valve	6.1543.060
Tip with anti-diffusion valve	6.1543.050

#### Miscellaneous:

Thermostat jacket for 6.3011.XXX and 6.3012.XXX Exchange Units with M8 thread	6.1563.010
PTFE tubing for thermostat jacket, 105 mm	6.1819.040
Coupling for thermostat jacket tubing	6.1808.050
Coupling for 6.1542.010 Ceramic Flat Stopcock in 6.3006.XXX and 6.3007.XXX Exchange Units	6.1564.000
SISCO 300 grease, 1 oz. (28.35 g)	6.2803.000

## 4. Standard operating procedure for checking the Dosimat within the framework of the GLP/ISO 900X guidelines

GLP (Good Laboratory Practice) requirements include the periodic check of analytical instruments for reproducibility and accuracy using **standard operating procedures**. As a standard operating procedure to check the Dosimat including the mounted Exchange Unit, METROHM recommends the procedure described below.

It would be good practice to repeat the check every year. If the dispensing unit is operated continuously or if the Exchange Unit is filled with etching or corrosive solutions, which can cause changes to the cylinder or the piston, more frequent checks may be necessary, such as every 6 or 3 months.

### 4.1 Instruments needed

- Dosimat.
- Exchange Unit with 6.1543.060 Burette Tip (without anti-diffusion valve), filled with dist. water free from CO<sub>2</sub> (boiled water) or another aqueous solution ( $c \leq 1$  mol/L) whose density is known exactly at the appropriate temperature.
- Analytical balance, resolution 0.1 mg.
- Narrow-necked Erlenmeyer flask. Select volume of the flask so that the entire measurement series can be dispensed without having to empty the flask between measurements.
- As appropriate, calibrated thermometer.
- As appropriate, density measuring apparatus to determine the density of the dispensed solution (e.g. pycnometer).
- As appropriate, device to measure atmospheric pressure.

### 4.2 Procedure

1. Measure temperature of water to be dispensed. If another liquid is dispensed, determine its density. Arrange the experimental setup so that it is protected against direct sunlight and drafts. Perform the measurement series without interruption.
2. Mount burette tip firmly on a stand rod. It must not be moved during the experiments. If possible, lead burette tip from above directly into the balance (cover weighing chamber at top). Place Erlenmeyer flask on the balance.
3. Set dispensing and filling rate of the Dosimat to "max.". It is important that a liquid jet is discharged during dispensing. With cylinder volumes  $< 10$  mL, this is not the case: Attach a pipette tip (e.g. a blue Eppendorf pipette tip) to the dispensing tubing. This pipette tip must have a sufficiently large orifice so that the drop does not become bigger when dispensing is at an end.
4. Dispense a few mL into the Erlenmeyer flask, leave the last drop suspended from the burette tip. On cessation of the liquid stream, the drop always has the same size. Leave the Erlenmeyer flask to stand for a while so that the air space above the liquid can become saturated with water vapour. This minimizes evaporation of the liquid. Possibly also place a small beaker containing a filter paper (to increase the surface area) immersed in water in the weighing chamber.
5. Tare Erlenmeyer flask.
6. Discharge volume into Erlenmeyer flask ( $<GO>$  key) and read off value on Dosimat. Leave the last drop suspended from the burette tip.
7. Fill ( $<FILL>$  key).
8. Weigh dispensed volume.

Repeat points 5 to 8: discharge 10 different volumes. The largest volume should be 1 cylinder volume, the smallest 0.1 cylinder volume. Select size of volume at random, do not use integral volume sizes all the time (see also example in section 4.3.4).

### 4.3 Evaluation of the results

The limits within which your results must lie are determined by you, matched to the demands of your application. In what follows, the limits suggested by METROHM are intended as standard values.

Note:

If in titrations the same dispensing unit is used for the titer determination and for the samples, the absolute accuracy of the dispensed volume is not significant as this deviation is taken into account in the titer. The only thing that is important is the linearity of the volume  $V_{set}$  vs the mass read off on the balance.

#### 4.3.1 Calculation of the discharged volume $V_{actual}$

For precision measurements, the air buoyancy in the weighing must be taken into account. The volume  $V_{actual}$  actually discharged is calculated taking the air buoyancy into account as follows:

$$V_{actual} = m_{read} * \underbrace{1/\rho_L * (1 + \rho_A/\rho_L - \rho_A/\rho_S)}_{\text{factor}} \quad 1)$$

where:

$V_{actual}$ : Discharged volume in mL, calculated from the weighing data

$m_{read}$ : Mass read off on the balance in g

$\rho_L$ : Density of the discharged liquid in g/mL

$\rho_A$ : Density of air in g/mL (density of dry air at 760 torr:  $\rho_A = 0.0012$  g/mL)

$\rho_S$ : Density of the standard used to calibrate the balance in g/mL  
(for brass weights:  $\rho_S = 8.4$  g/mL)

As an approximation for dist. water, the correction factors in the following table can be used (calculated with  $\rho_A = 0.0012$  g/mL, calibration of the balance with brass weights  $\rho_S = 8.4$  g/mL):

t in °C	Factor	t in °C	Factor
19.0	1.002667	25.0	1.004036
20.0	1.002868	26.0	1.004298
21.0	1.003079	27.0	1.004571
22.0	1.003301	28.0	1.004853
23.0	1.003532	29.0	1.005146
24.0	1.003784	30.0	1.005449

If another liquid is dispensed, its density must be determined in an independent measurement. The following table can be used as a reference for the density of different aqueous solutions at 20°C (taken from Küster, Thiel, Rechentafeln für die Chemische Analytik, 103<sup>rd</sup> edition, Walter de Gruyter-Verlag, 1985, page 126 ff).

Solution	Density $\rho_{20^{\circ}\text{C}}$ g/mL	Concentration c mol/L
<b>HCl</b>	1.000	0.09874
	1.005	0.3749
	1.015	0.9393
	1.020	1.228
<b>NaOH</b>	1.000	0.0398
	1.005	0.151
	1.040	0.971
	1.045	1.097

Knowing the density of the solution, formula 1) can be used to calculate the factor and  $V_{\text{actual}}$ .

#### 4.3.2 Relative error

The relative error is calculated as follows:

$$\text{rel. error} = \frac{V_{\text{actual}} - V_{\text{set}}}{V_{\text{set}}} * 100$$

$V_{\text{actual}}$ : Discharged volume in mL calculated from the weighing data (formula 1)

$V_{\text{set}}$ : Volume read off on Dosimat in mL

According to DIN/ISO, the error is specified for the nominal volume of the cylinder.

Nominal volume of the Exchange Unit mL	Error limits according to <b>METROHM</b>		Error limits according to <b>DIN</b>	
	Deviation from the nominal volume $\pm \mu\text{L}$	max. rel. error %	Deviation from the nominal volume $\pm \mu\text{L}$	max. rel. error %
5	15	0.3	15	0.3
10	20	0.2	30	0.3
20	30	0.15	60	0.3
50	50	0.1	150	0.3

Measurements show that these error limits also apply to volumes smaller than the nominal volume in nearly all cases. With measured points for smaller volumes, the probability is greater that they will lie somewhat outside the error limit as here the measurement error becomes more important.

### 4.3.3 Linear regression

A linear regression of  $V_{\text{actual}}$  vs  $V_{\text{set}}$  is performed (use a pocket calculator or statistics program on a PC). Here,  $V_{\text{actual}}$  is entered as the y coordinate (dependent variable) and  $V_{\text{set}}$  as the x coordinate (independent variable). The following limit values are suggested as standard values:

► **Slope**

The slope of the regression line should lie between **0.997 and 1.003**.

► **Intercept on y axis**

Intercept in  $\mu\text{L} < 3 \times$  volume resolution of the Exchange Unit, i.e.

Nominal volume of the Exchange Unit mL	Resolution $\mu\text{L}$	Intercept $\pm \mu\text{L}$
5	0.5	1.5
10	1	3
20	2	6
50	5	15

The linear regression defines a straight line through the measured points such that the square deviations of y are minimized. If you can not calculate the linear regression on a pocket calculator or on the PC, the regression values have to be calculated manually using the following formulas:

$$\text{Slope} = \frac{\sum(x_i - x_m)(y_i - y_m)}{\sum(x_i - x_m)^2}$$

$$\text{Intercept} = y_m - \text{Slope} * x_m$$

$$\text{Correlation coefficient} = \frac{\sum(x_i - x_m)(y_i - y_m)}{\sqrt{\sum(x_i - x_m)^2 * \sum(y_i - y_m)^2}}$$

where

$x_i$  resp.  $y_i$  = individual measured value x (=  $V_{\text{set}}$ ) resp. y (=  $V_{\text{actual}}$ )

$x_m$  resp.  $y_m$  = Media of x (=  $V_{\text{set}}$ ) resp. y (=  $V_{\text{actual}}$ )

Build sums over all measured values (i = 1...10)

### 4.3.4 Example for a 10 mL Exchange Unit

Temperature	23.5 °C		
Atmospheric pressure	696 mm Hg	<i>Regression data</i>	
		Slope	1.00104
Dispensed liquid	Boiled dist. water	Intercept	0.0016 mL = 1.6 $\mu\text{L}$
Density (from table)	0.9977417 g/mL	Correlation coefficient	0.999999945
Calculation factor	1.0036527		

$V_{\text{set}}$ mL	Mass g	$V_{\text{actual}}$ mL	$V_{\text{actual}} - V_{\text{set}}$ $\mu\text{L}$	rel. error %
4.061	4.0501	4.0649	3.9	0.096
1.905	1.9016	1.9085	3.5	0.184
9.105	9.0818	9.1149	9.9	0.108
7.979	7.9598	7.9889	9.9	0.124
7.077	7.0612	7.0870	10.0	0.141
10.000	9.9754	10.0118	11.8	0.118
2.999	2.9937	3.0046	5.6	0.187
5.010	4.9999	5.0182	8.2	0.164
1.000	0.9983	1.0019	1.9	0.190
5.938	5.9241	5.9457	7.7	0.130

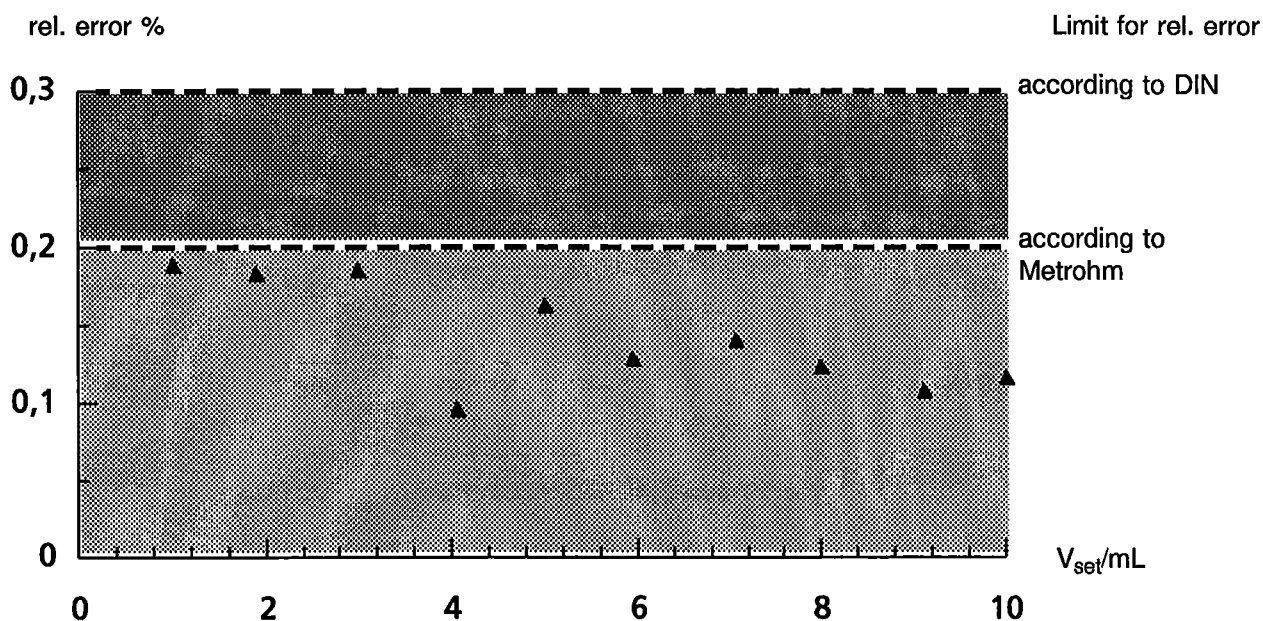
Calculation of the calculation factor and the first  $V_{\text{actual}}$  using formula 1):

$$\begin{aligned} V_{\text{actual}} &= m_{\text{read}} \cdot 1/\rho_L \cdot (1 + \rho_A/\rho_L - \rho_A/\rho_S) \\ &= 4.0501 \cdot 1/0.997417 \cdot (1 + 0.0012/0.997417 - 0.0012/8.4) \\ &= 4.0501 \cdot \underbrace{1.0036527}_{\text{calculation factor, constant for all calculations of the series}} = 4.0649 \end{aligned}$$

where:

- $m_{\text{read}}$ : Mass read off on balance
- $\rho_L$ : Density of water at 23.5°C = 0.997417 g/mL
- $\rho_A$ : Density of dry air at 760 torr = 0.0012 g/mL
- $\rho_S$ : Density of brass calibration weights = 8.4 g/mL

Graphical representation of the relative error versus  $V_{\text{set}}$ :



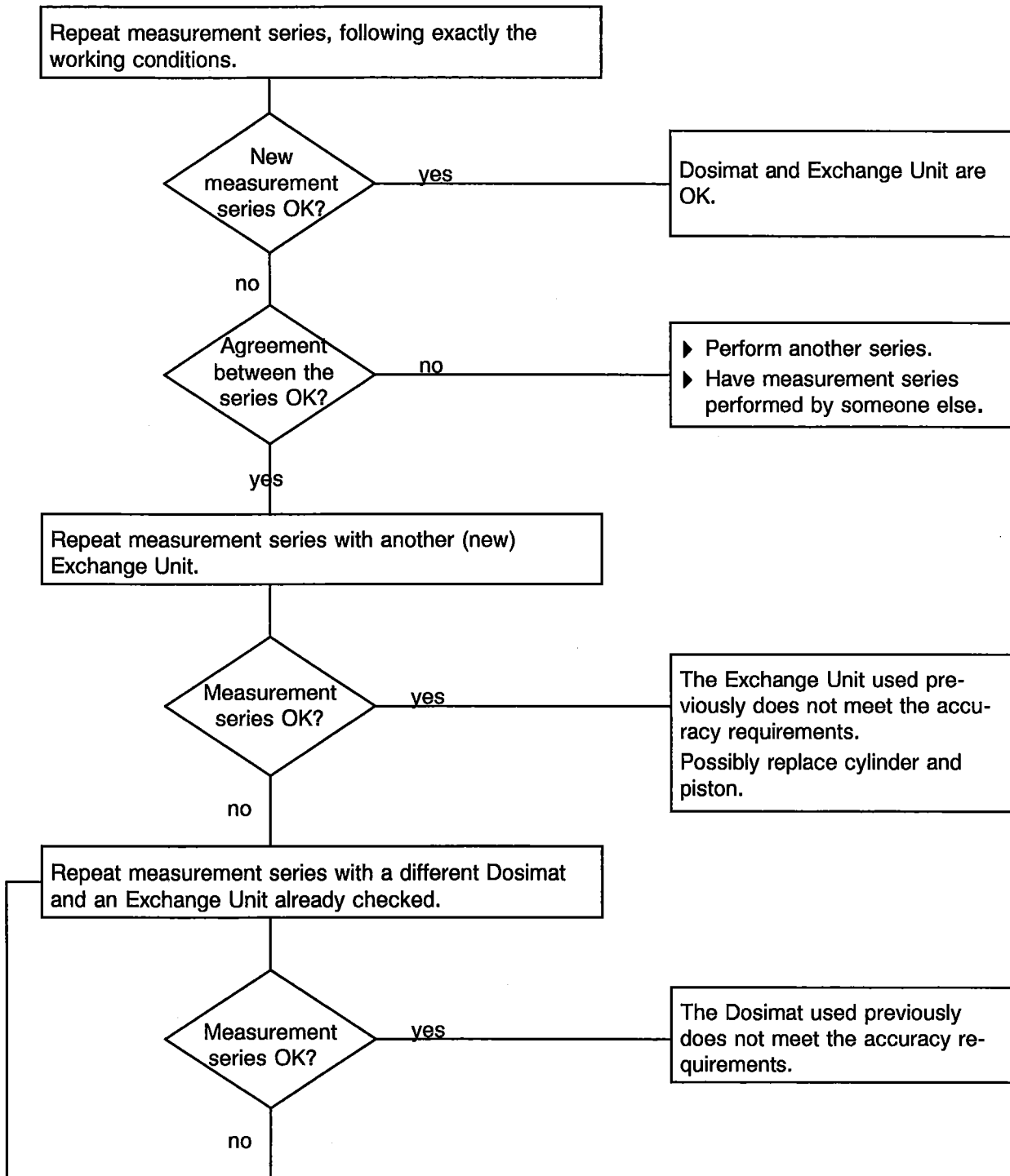
If you recalculate the example, the results of the linear regression may be slightly different from the values above due to different internal arithmetic resolutions on different calculators.

#### 4.3.5 References

- DIN 12650, parts 5 and 6: Volumenmessgeräte mit Hubkolben. Beuth-Verlag, GmbH, Berlin 30 and Cologne.  
and the standards and documents cited therein.
- ISO/TC 48/SC1 N 380E to 383E: Piston and/or Plunger Operated Volumetric Apparatus (POVA).

#### 4.4 How should I proceed if the values are not within the limits?

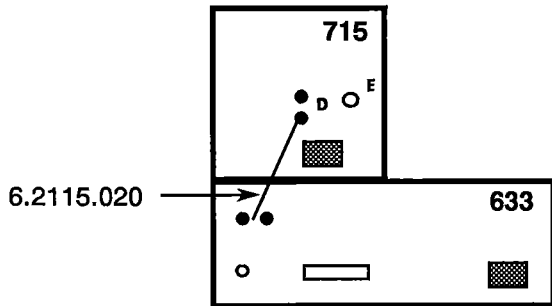
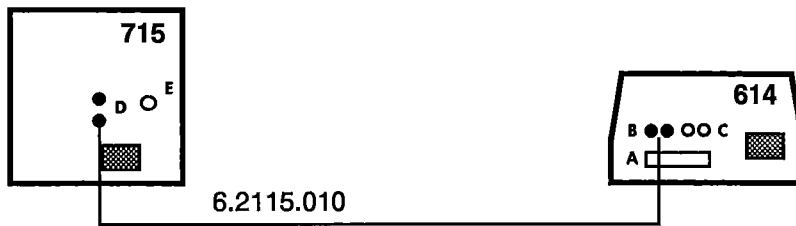
Is the density of the dispensed liquid correct? If you have dispensed water, check the thermometer.  
If everything appears to be in order:



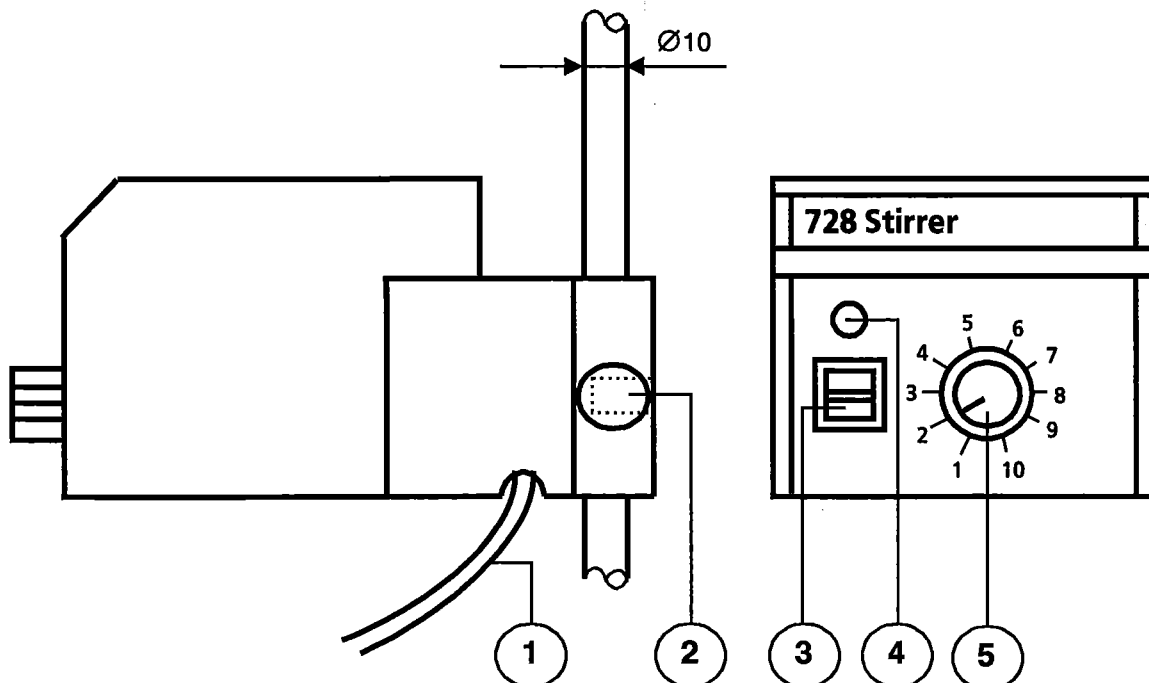


## 5. Appendix

### 5.1. Connections to 614 Impulsomat and 633 KF Automat



### 5.2. Instructions for Use for 728 Magnetic Stirrer



- (1) Connecting cable
- (2) Fastening screw
- (3) On/off switch
- (4) Pilot lamp, supply
- (5) Regulation of stirring speed

Fastening The stirrer is mounted on a stand rod  $\varnothing = 10$  mm. It is fixed at the appropriate height using screw (2) so that it can be swung out to the left or right from the working position.

Power supply  $U_{DC} \approx 8$  V

Stirring speed stabilised,  $n \approx 200 \dots 1900$  min<sup>-1</sup> (without load)

Stirring bar PTFE coating, magnetic core

	Length	Dimensions	Shape
6.1903.000	8 mm	$\varnothing = 4$ mm	O
6.1903.010	12 mm	$\varnothing = 4$ mm	O
6.1903.020	16 mm	$\varnothing = 4$ mm	O
6.1903.030	25 mm	$\varnothing = 5$ mm	O
6.1906.000	42 mm	-	$\Delta$
6.1906.010	25 mm	-	$\Delta$
6.1906.020	26 mm	-	oval

### 5.3 Technical specifications

Exchange units 1, 5, 10, 20, 50 ml burette cylinder volumes, with flat cock

Resolution 10'000 pulses per 100% of burette volume

Resolution and error for the different exchange units

$V_{cylinder}$ ml	Resolution of display $\mu$ l	Absolute error $\mu$ l	Reproducibility error $\mu$ l
1	1	$\pm 3$	$\pm 1$
5	1	$\pm 15$	$\pm 5$
10	1	$\pm 20$	$\pm 5$
20	2	$\pm 30$	$\pm 10$
50	5	$\pm 50$	$\pm 40$

Dispensing time for 100% of burette cylinder volume analogue setting 20 s ... 17 min

Display Vacuum fluorescence display (VFD), 16 characters

Materials

Cabinet  
Key cover

Polybutylene terephthalate (PBTP)  
Polycarbonate (PC)

Temperature range	Ambient temperature + 5... + 40° Storage, transport -20... + 60°
Safety specifications	The design and construction are in accordance with the safety specifications of IEC Publication 1010, safety class I. This manual contains some information and warnings which have to be followed by the user to ensure safe operation and to retain the apparatus in safe condition.
Power supply	Before switching on the apparatus, make sure that it is set to the voltage of the power supply.
voltage	100, 117, 220, 240 V ± 10%
frequency	50... 60 Hz
consumption	15 VA
fuse	thermal fuse (80 °C)
Dimensions	
Dosimat with exchange unit	
width	150 mm
height	450 mm
depth	275 mm
Weight	
Dosimat with exchange unit	app. 4 kg

## 5.4 Warranty and certificates

The warranty regarding our products is limited to rectification free of charge in our workshops of defects that can be proved to be due to material, design or manufacturing faults which appear within 12 months from the day of delivery. Transport costs are chargeable to the orderer.

For day and night operation, the warranty is valid for 6 months.

Glass breakage in the case of electrodes or other glass parts is not covered by the warranty. Checks which are not a result of material or manufacturing faults are also charged during the warranty period. For parts of outside manufacture insofar as these constitute an appreciable part of our instrument, the warranty stipulations of the manufacturer in question apply.

With regard to the guarantee of accuracy, the technical specifications in the Instructions for Use are authoritative.

Concerning defects in material, construction or design as well as the absence of guaranteed features, the orderer has no rights or claims except those mentioned above.

If damage of the packaging is evident on receipt of a consignment or if the goods show signs of transport damage after unpacking, the carrier must be informed immediately and a written damage report demanded. Lack of an official damage report releases METROHM from any liability to pay compensation.

If any instruments and parts have to be returned, the original packaging should be used if at all possible. This applies above all to instruments, electrodes, burette cylinders and PTFE pistons. Before embedding in wood shavings or similar material, the parts must be packed in a dustproof package (for instruments, use of a plastic bag is imperative). If open assemblies are enclosed in the scope of delivery that are sensitive to electromagnetic voltages (e.g. data interfaces etc.) these must be returned in the associated original protective packaging (e.g. conductive protective bag). (Exception: assemblies with built-in voltage source belong in a non-conductive protective packaging). For damage which arises as a result of non-compliance with these instructions, no warranty responsibility whatsoever will be accepted by METROHM.

Ionenanalytik • Analyse des ions • Ion analysis • Análisis iónico  
**715 Dosimat**



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### Certificate of Conformity and System Validation

This is to certify the conformity to the standard specifications for electrical appliances and accessories, as well as to the standard specifications for security and to system validation issued by the manufacturing company.

Name of commodity:	715 Dosimat
System software:	Stored in ROMs
Name of manufacturer:	Metrohm Ltd., Herisau, Switzerland

This Metrohm instrument has been built and has undergone final type testing according to the standards:

<i>Electromagnetic compatibility: Emission</i> EN55022 / class B, EN50081-1/92	Generic emission
<i>Electromagnetic compatibility: Immunity</i> EN50082-1/92	Immunity
IEC801-2/91 class 4, NAMUR	Static discharge
IEC801-3, class 2	Radiated rf electromagnetic field immunity
IEC801-4, class 3	EI. fast transient requirements
IEC801-5, class 2/3	"Surges" immunity
EN50093	Voltage dips, short interruptions
<i>Security specifications</i> IEC1010, EN61010 class 2, UL3101-1	

The technical specifications are documented in the instruction manual.  
The system software, stored in Read Only Memories (ROMs) has been validated in connection with standard operating procedures in respect to functionality, analytical performance, and accuracy of results.  
The features of the system software are documented in the instruction manual.

Metrohm Ltd. is holder of the SQS-certificate of the quality system ISO 9001 for quality assurance in design/development, production, installation and servicing.

Herisau, Dec. 6, 1995

Dr. J. Frank  
Development Manager

Ch. Buchmann  
Production and  
Quality Assurance Manager

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**715 Dosimat**



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## EU Declaration of Conformity

The METROHM LTD. company, Herisau, Switzerland hereby certifies, that the instrument:

**715 Dosimat**

meets the requirements of EC Directives 89/336/EWG and 73/23/EWG.

---

### Source of the specifications:

EN 50081-1	Electromagnetic compatibility, basic specification Emitted Interference
EN 50082-1	Electromagnetic compatibility, basic specification Interference Immunity
EN 61010	Safety requirements for electrical laboratory measurement and control equipment

### Description of the instrument:

Dosing element for titration and dosing tasks.

---

Herisau, december 6, 1995

Handwritten signature of Dr. J. Frank in black ink.

Dr. J. Frank  
Head of engineering dept.

Handwritten signature of Ch. Buchmann in black ink.

Ch. Buchmann  
Head of production dept.  
Management representative

## 5.5 Scope of delivery and ordering designations

715 Dosimat	2.715.0020
including the following accessories:	
1 x Exchange Unit, 20 ml	6.3014.223
1 x Push rod for Exchange Units	6.2739.010
1 x Cable with manual feed push-button, length: 1 m	6.2107.000
1 x Mains cable,	
Socket Type CEE(22), V; plug according to customer's requirements:	
Type SEV 12 (Switzerland... )	6.2122.020
Type CEE(7), VII (Germany... )	6.2122.040
Type NEMA /ASA (USA...)	6.2122.070
1 x Operating Instructions	8.715.1023

### Options

Exchange Units, see also chapter 3, e.g. with PCTFE/PTFE cock and light protection	
5 ml	6.3014.153
10 ml	6.3014.213
20 ml	6.3014.223
50 ml	6.3014.253
728 Magnetic Stirrer	2.728.0040
722 Rod Stirrer	2.722.0010
703 Ti Stand	2.703.0010
Cable with foot feed switch, length: 2 m	6.2107.010
Connecting cable 715 - 614	6.2115.010

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Displays are designated with  , keys with < >.

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