METROHM Ltd. CH-9101 Herisau (Switzerland)

Dosimat 725

Series 01 ...

8.725.1013 93.08 Ti/gg

Metrohm Short operating guide 725 Dosimat

Modes

DOS	Dosing
DIS R	Repetitve dispensing
DIS C	Cumulative dispensing
PIP	Pipetting
DIL	Diluting
CNT D	Content Dispenser, preparation of solutions of preselected contents

Selection of modes with <mode>. Press key so many times until the right mode is displayed, then press <enter>.

Mode	Parameter	Explanation	Standard value	Input range
DOS	**Δvolume:**			
	V-LIM	Security volume; stop if V-LIM is reached	OFF	.001...999.999 ml; OFF
	rate:			
	↑	Expelling rate	OFF	.001...150 ml/min; OFF
	↓	Filling rate	max.	.001...150 ml/min; OFF
	blank	Blank	0 ml	0... ±999.999 ml
	factor	Factor	1	0... ±1E33
	smpl	Sample size	1	0... ±1E33
	unit	Unit for result calculation	-	Selectable units
DIS R	**Δvolume:**			
	V-DIS	Dispensing volume	1 ml	.001... 999.999 ml
	rate:			
	↑	Expelling rate	OFF	.001...150 ml/min; OFF
	↓	Filling rate	max.	.001...150 ml/min; OFF
DIS C	**Δvolume:**			
	V-DIS	Dispensing volume	0.1 ml	.001... 999.999 ml
	V-LIM	Security volume; stop if V-LIM is reached	OFF	.001... 999.999 ml; OFF
	rate:			
	↑	Expelling rate	OFF	
	↓	Filling rate	max.	.001...150 ml/min; OFF
				.001...150 ml/min; OFF
PIP	**Δvolume:**			
	V-PIP	Pipetting volume	0.1 ml	.001... 49.5 ml
	rate:			
	↓	Aspirating rate	OFF	.001...150 ml/min; OFF
	↑	Expelling rate	OFF	.001...150 ml/min; OFF
DIL	**Δvolume:**			
	V-PIP	Pipetting volume	0.1 ml	.001... 49.5 ml
	V-DIL	Diluting volume	1 ml	.001... 999.999 ml;OFF
	rate:			
	↓	Aspirating rate	OFF	.001...150 ml/min; OFF
	↑	Expelling rate	OFF	.001...150 ml/min; OFF
CNT D	**rate:**			
	↑	Expelling rate	OFF	.001...150 ml/min; OFF
	↓	Filling rate	max.	.001...150 ml/min; OFF

User memory

Storing a mode:	<store><X><enter>, X = 0, 1 ... 9
Recalling a stored mode:	<recall><X><enter>, X = 0, 1 ... 9

Instructions for use
725 Dosimat

Contents

Explanation of symbols:

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

 means "display"

1. Operating elements on the 725 Dosimat and their function

(1) Exchange unit

Normally models with automatic cock changeover.

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 with your finger to the right side. Do not turn cock with Dosimat switched off!

(2) Display

The 16 digit display shows all important information:

/DOS 3.456 ml/	Mode (DOS = dosing) and dosed volume. Dosimat is in stand-by position.
/DOS ↑ 3.456 ml/	as above, but with Dosimat busy; piston is moving upwards.
/DOS ↓ 3.456 ml/	as above; but piston is moving downwards.

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

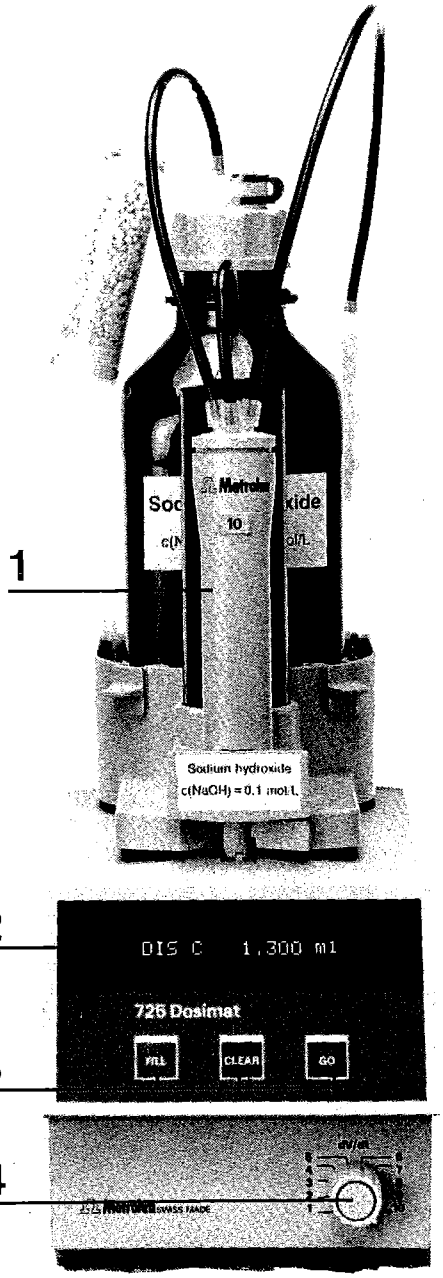
(3) Operating keys at the Dosimat

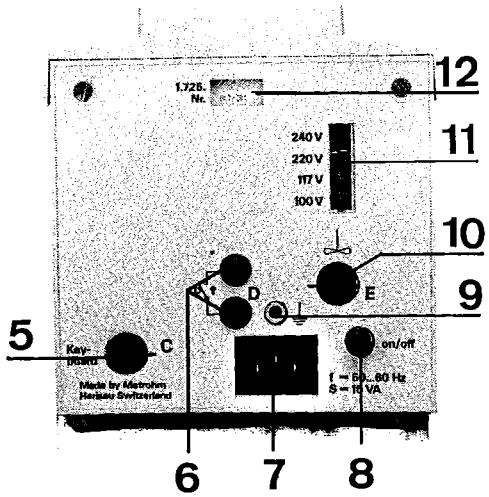
FILL: Filling. This key is always accessible and serves also as emergency stop.
CLEAR: Resetting of the volume display to 0.000 ml (with Dosimat in stand-by position).
GO: Start of mode.
With mode DOS, dosing goes on as long as <GO> is pressed.

(4) Analogue setting of dosing rate

Position 1 = lowest rate
Position 10 = highest rate

Expelling and filling rate can be set separately (see page 6).


1
Sodium hydroxide
c(NaOH) = 0.1 mol/L
2
DIS C 1.300 ml
725 Dosimat
3
FILL
CLEAR
GO
4


12
1.725.
11
240 V
220 V
117 V
100 V
10
D
E
9
5
Key-
board
C
on/off
6
7
8

5 **Connection for keyboard**

(For details of operation with 6.2124.100 keyboard see page 4ff).

6 **Connection for external dosing contact**

E.g. 6.2107.000 push button cable or 6.2107.010 foot switch.

7 **Mains connection**

In power supply systems, in which strong HF interferences (transients) are superimposed on the mains voltage, the 725 Dosimat should be connected via an additional powerline filter, e.g. METROHM 615 model.

8 **Main switch**

Switching on and off 725 Dosimat.
The 725 Dosimat is equipped with a non-volatile memory, i.e. set parameters remain in the working memory if the Dosimat is switched off and on.

9 **Earthing socket**

The 725 Dosimat must be grounded effectively, if necessary through the separate earthing socket.

10 **Connection for stirrer**

Magnetic Stirrer, Rod Stirrer, or Ti Stand.

Supply voltage output: +9 V DC ($I \leq 200$ mA)

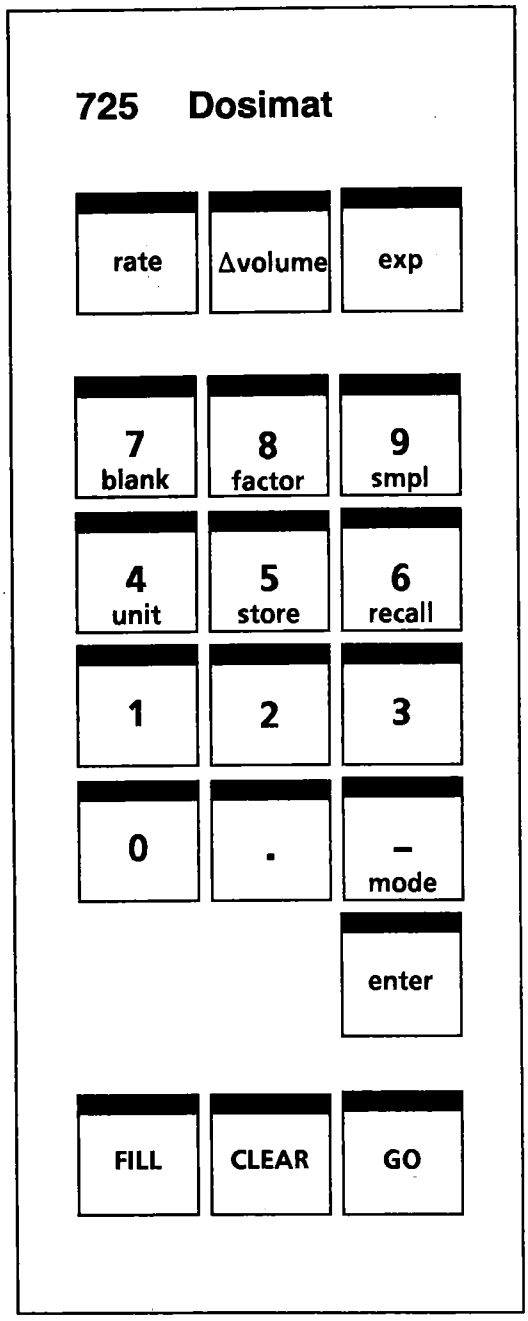
11 **Indication of mains voltage**

12 **Identification plate**

Indication of model, series and serial number.

2. Operation with the keyboard

2.1 Keyboard, data input



Keys for parameters and exponent.
Pressing <rate> and <Δ volume> several times, display shows new inquiries.

Calculation parameters:
<blank>, <factor>, <smpl>, <unit>.

Management of user memory:
<store>, <recall>.

Mode selection:
<mode>. Pressing <mode> several times, display shows new modes.

Main functional keys,
identical with the corresponding keys on the 725 Dosimat.

Rules for data input:

- On entering a negative number, key in minus sign first; <-> is not a change of sign key!

- Changeover between first functions (blank, factor etc.) and digits is done automatically. Terminate parameter entries with <enter>.

- Some keys are organized as inquiry drums, i.e. pressing these keys several times, display shows new inquiries. A new value is stored or a new feature is selected with <enter>. The program then returns to the initial state, the inquiry drum is left. Entering an inquiry drum, that inquiry, where the drum has been left last time, is displayed first.

- The Dosimat works with a resolution of 10'000 pulses per burette cylinder volume. Resolution in display therefore depends on the exchange unit used:

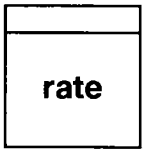
Exchange unit	Resolution of display	
	Δvolume ml	rate ml/min
1 ml	.001	.001
5 ml	.001	.005
10 ml	.001	.010
20 ml	.002	.020
50 ml	.005	.050

If a volume value is entered which can not be dosed exactly with the exchange unit on the Dosimat, the value is rounded off to the next possible one and stored accordingly.

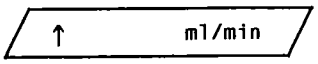
- Key <CLEAR> sets parameters 'rate↑', 'rate↓' and 'V-LIM' to "OFF".

2.1.1 Key <rate>

The inquiries of this key are identical for all modes.



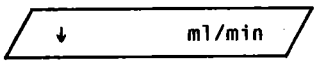
rate: Expelling and filling rate.
This key is accessible live-keyboard (except in mode "DOS"), i.e. rate can be changed during a running function.



Expelling rate.
The range for digital setting depends on the volume of the exchange unit (EU):

1 ml EU:	.001 ...	3.00 ml/min
5 ml EU:	.005 ...	15.0 ml/min
10 ml EU:	.010 ...	30.0 ml/min
20 ml EU:	.020 ...	60.0 ml/min
50 ml EU:	.050 ...	150. ml/min

Key <CLEAR> sets ↑ OFF ml/min , i.e. the rate can be controlled analogically by means of the potentiometer at the 725 Dosimat.
If the preset rate is too high to be dosed with the exchange unit presently mounted, the rate is set automatically to its maximum.



Filling or aspirating rate.
The data input rules are the same as for ↑.
Additional, the filling or aspirating rate is set to maximum on changing the exchange unit (e.g. after no exch. unit! *is displayed).*

2.2 Modes

DOS: DOSing;
Dosimat is dosing as long as <GO> is pressed. Result calculation can be activated.

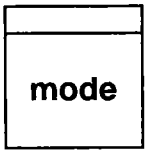
DIS R: DISpensing, Repetitive;
Dosimat is dosing a stored dispensing volume if <GO> is pressed, burette cylinder is refilled and display reset to 0.000 ml.

DIS C: DISpensing, Cumulative;
Dosimat is dosing a stored dispensing volume if <GO> is pressed, and the dispensed volume (V-DIS) remains displayed.

PIP: PIPetting;
Aspirating and subsequent expelling of a stored pipetting volume.

DIL: DILuting;
Aspirating a stored pipetting volume and subsequent expelling of the pipetting and diluting volume.

CNT D CoNTent Dispenser;
Preparation of solutions with preselected content.



mode: The different modes are selected by the inquiry drum <mode> and loaded into the working memory with <enter>.

Example: Selection of mode "DIS C", cumulative dispensing.

Press <mode>.

Display shows that mode which has been selected last with key <mode>, *e.g.*

DOS .

Press <mode> *so many times until display shows*

DIS C .

Load mode "DIS C" into working memory with <enter>.

Display shows DIS C 0.000 ml.

Now mode "DIS C" is ready to work, the piston is in zero position.

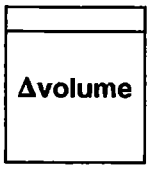
All modes which are loaded into the working memory by key <mode> are equipped with a set of standard parameters:

Mode	V-DIS/V-PIP ml	V-LIM/V-DIL ml	↑ ml/min	↓ ml/min	Calculation
DOS	-	OFF	OFF	max.	b = 0; f = 1; s = 1
DIS R	1	-	OFF	max.	–
DIS C	0.1	OFF	OFF	max.	–
PIP	0.1	-	OFF	OFF	–
DIL	0.1	1	OFF	OFF	–
CNT D	–	–	OFF	max.	–

2.2.1 Mode DOS, Dosing

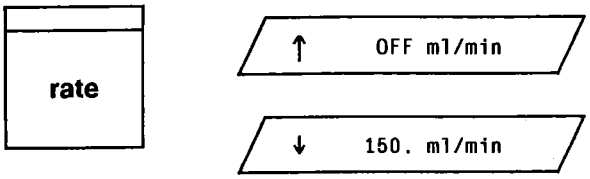
DOS 0.000 ml

Standard parameters:



V-LIM OFF

Security volume:
Dosing is stopped if V-LIM is reached
.001 ... 999.999 ml, OFF

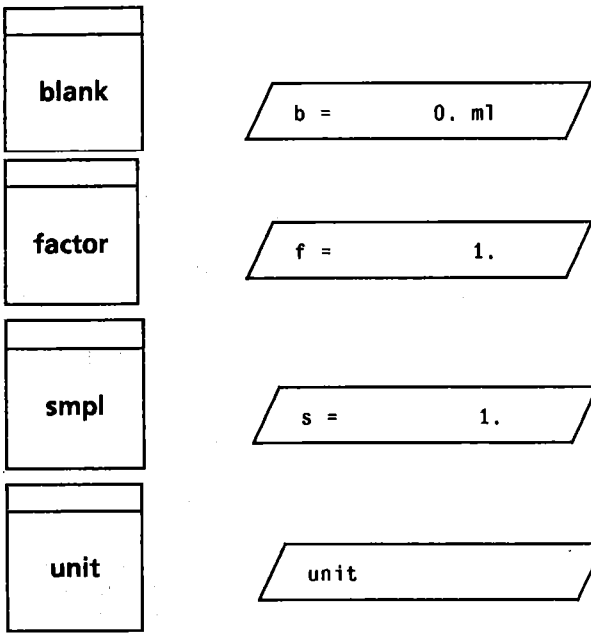


Expelling rate

Input range see page 6

Filling rate

Calculation values:



Blank value
0 ... ± 999.999 ml

Factor
0 ... ± 1E33

Sample size
0 ... ± 1E33

Unit
none, ppm, %, g, mg, g/l, mg/l, mol, mol/l, ml, l, /pc (per piece)

Special settings: see page 23

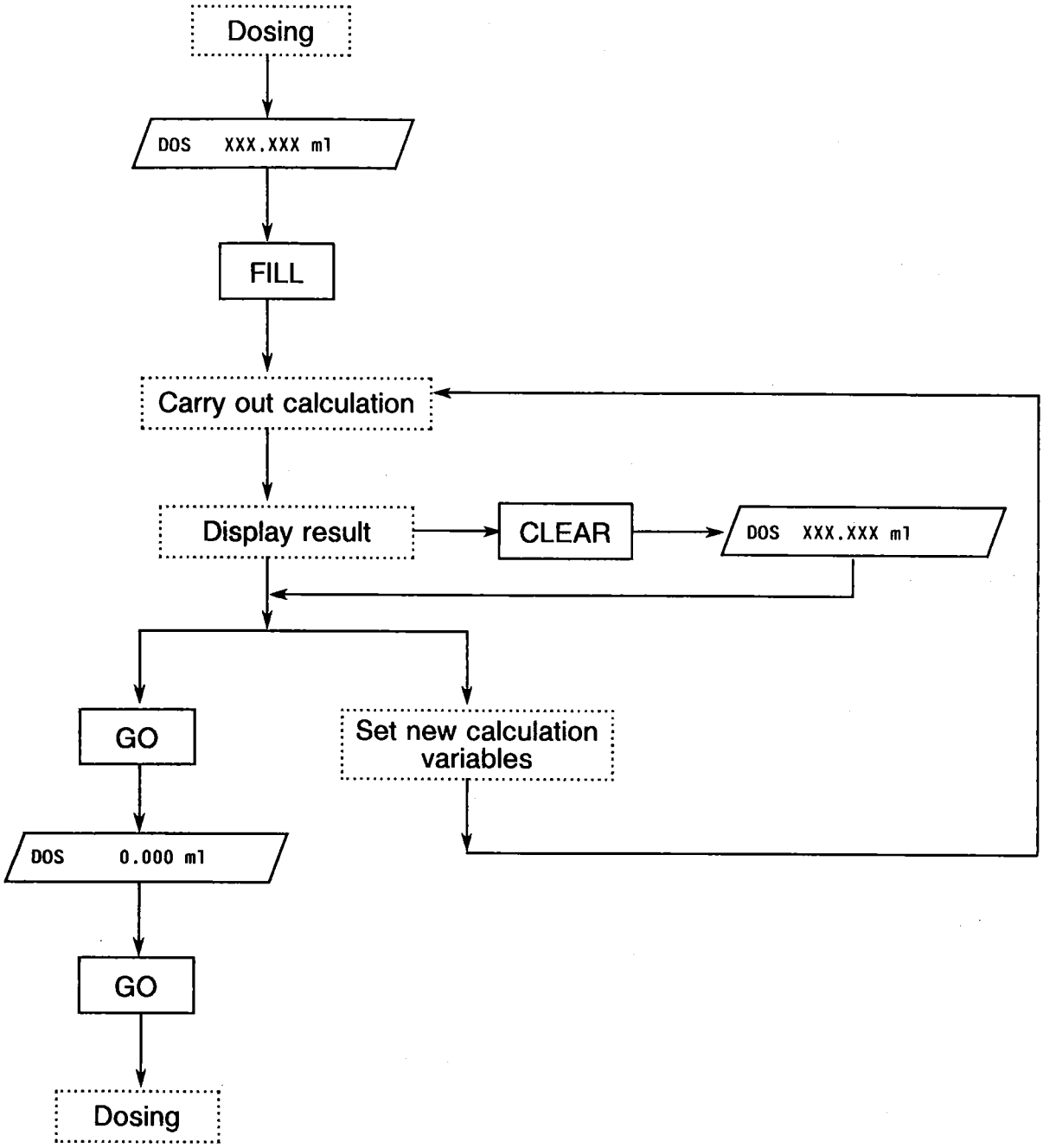
Result calculation:

If one of the calculation values (blank, factor, smpl) is not set to its standard value, a result is calculated on filling of the Dosimat according to formula:

$$\text{Result} = \frac{(\text{dosed volume} - \text{blank}) * \text{factor}}{\text{smpl}}$$

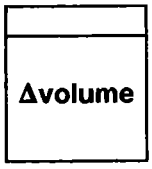
The result is recalculated on every entry of a calculation value (blank, factor, smpl).
Pressing key <CLEAR>, display shows the dosed volume in ml.
To start a new dosing, press <GO> twice. Pressing <GO> once resets the volume in display to 0.000 ml.

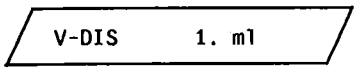
Scheme, summary of possibilities in mode "DOS" with result calculation:



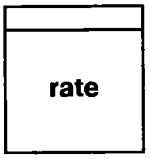
2.2.2 Mode DIS R, repetitive dispensing

Standard parameters:

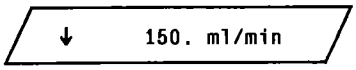




Dispensing volume
.001 ... 999.999 ml



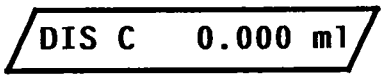
Expelling rate
Input range see page 6



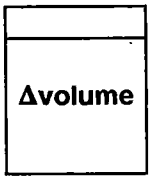
Filling rate

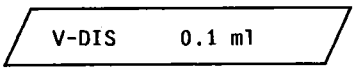
Special settings: see page 23

2.2.3 Mode DIS C, cumulative dispensing

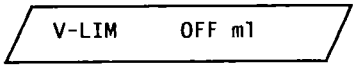


Standard parameters:

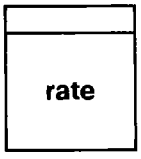


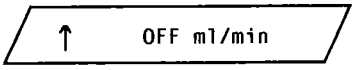


Dispensing volume
.001 ... 999.999 ml

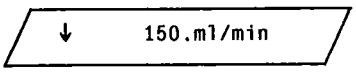


Security volume:
Dosing is stopped if V-LIM is reached.
.001 ... 999.999 ml, OFF





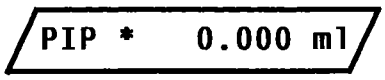
Expelling rate
Input range see page 6



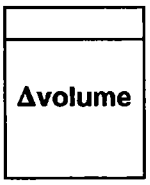
Filling rate

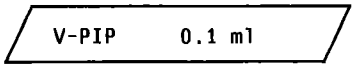
Special settings : see page 23

2.2.4 Mode PIP, pipetting



Standard parameters:

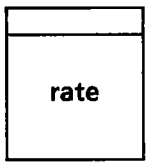


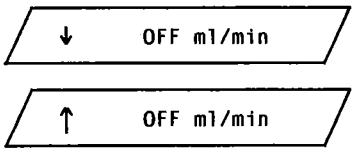


Pipetting volume
Input range depends on the volume of the exchange unit (EU):

1 ml EU:	0.001 ... 0.900 ml
5 ml EU:	0.001 ... 4.900 ml
10 ml EU:	0.001 ... 9.800 ml
20 ml EU:	0.002 ... 19.700 ml
50 ml EU:	0.005 ... 49.500 ml

Note:The liquid of the exchange unit is mixed with the pipetted liquid if it is aspirated into the burette cylinder!





Aspirating rate

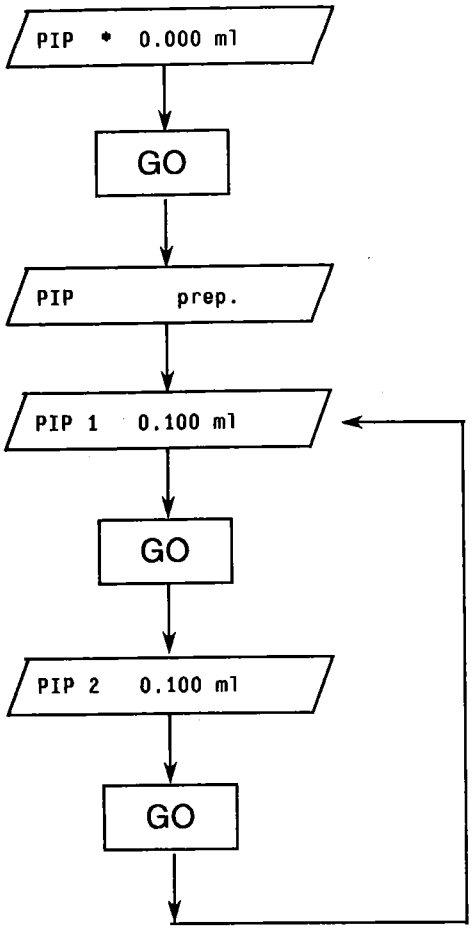
Input range see page 6

Expelling rate

Sign * in the display means that mode "PIP" is not yet ready to use. With a first <GO>, a preparation step is carried out which is marked in display with PIP prep.. This preparation step includes the formation of an air bubble which serves to separate the transfer solution of the exchange unit from the sample.
Then display shows PIP 1 0.100 ml , i.e. the Dosimat is ready to aspirate the pipetting volume (0.1 ml). With <GO> the pipetting volume is aspirated and display shows PIP 2 0.100 ml , which means that the Dosimat is ready to expel the pipetting volume. With the next <GO>, the volume is expelled and the Dosimat is then ready to aspirate the next pipetting volume without any preparation step.
If the pipetting volume is changed, a new preparation step is always carried out.

Note: A new air bubble is built with every preparation step, e.g. its volume increases. If you wish to keep the volume of the air bubble expel it in Mode DOS before changing V-PIP.

Summary of steps in mode "PIP":



Standard mode PIP

Preparation step
(Hold burette tip free)

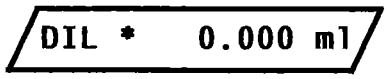
Ready to aspirate the pipetting volume
(Immerse burette tip)

Ready to expel the pipetting volume
(Hold burette tip for pipetting)

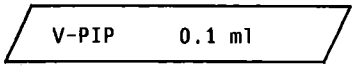
Notes:

- For best pipetting results we recommend exchange units with volumes ≤ 20 ml and 6.5611.000 pipetting equipment, see page 52. The aspirating and expelling rates should not be higher than 20 ml/min.
- Hold tubing tip in an angle of app. 45° to the vessel wall during pipetting. Just the same as you do with glass pipettes!
- The vessel, containing the liquid you want to pipette should stand on the same level as the vessel into which you are going to expel the liquid in order to ascertain app. the same level of the pipetting tubing during work.

2.2.5 Mode DIL, diluting

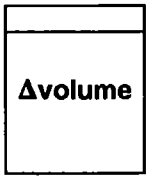


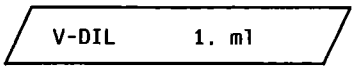
Standard parameters:



Pipetting volume
Input range depends on the volume of the exchange unit (EU):

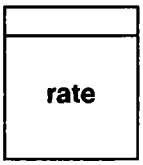
1 ml EU:	0.001 ...	0.900 ml
5 ml EU:	0.001 ...	4.900 ml
10 ml EU:	0.001 ...	9.800 ml
20 ml EU:	0.002 ...	19.700 ml
50 ml EU:	0.005 ...	49.500 ml

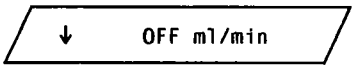




Diluting volume
.001 ... 999.999 ml

Note: The diluting liquid is unintentionally mixed with the pipetted liquid if it is aspirated into the burette cylinder!





Aspirating rate

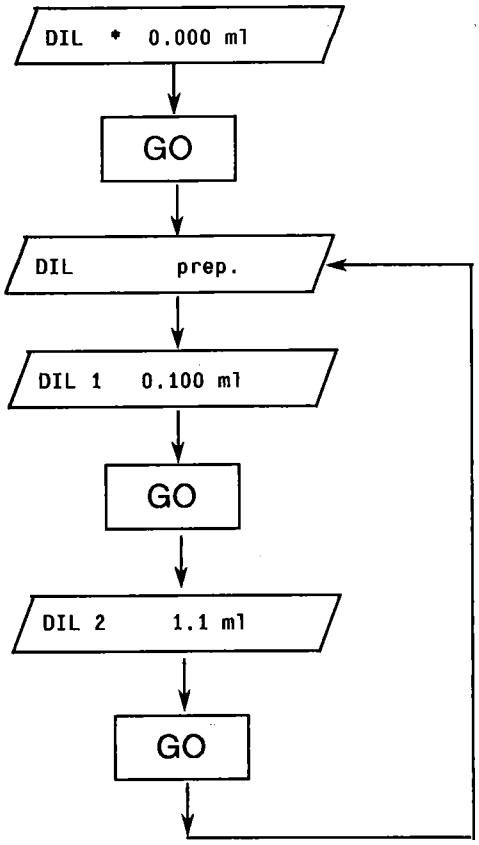
Input range see page 6

Expelling rate

Sign * in the display tells you that mode "DIL" is not ready to use. With <GO> a preparation step is carried out during which V-PIP is expelled into the bottle of the exchange unit and an air bubble is built to separate the solution of the exchange unit from the sample. Then the Dosimat is ready to aspirate the pipetting volume (0.1 ml) which is displayed by DIL 1 0.100 ml and carried out after pressing <GO>.
Then DIL 2 0.100 ml is displayed which means that the Dosimat is ready to expel the pipetting and the diluting volume (0.1 ml + 1 ml = 1.1 ml). This is executed after pressing <GO>. The preparation step is now carried out automatically and the Dosimat is ready to aspirate the next pipetting volume.

Note: If you wish to change V-PIP, it is best to change it during filling in the preparation step, e.g. when display shows DIL ↓ prep.
If V-PIP is changed at another time, a new preparation step is carried out, which changes the volume of the air bubble. The first dilution after such a change could be erronous and should be discarded. Or expel air bubble in mode DOS and start Mode DIL from the beginning.
V-DIL can be changed at any time without a new preparation step.

Summary of steps in mode "DIL":



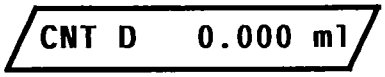
Standard mode DIL

Preparation step
(Hold burette tip free)

Ready to aspirate the pipetting volume
(Immerse burette tip)

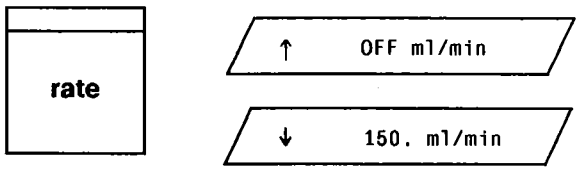
Ready to expel the pipetting and the diluting volumes
(Hold burette tip for pipetting)

2.2.6 Mode CNT D, Content Dispenser



Mode CNT D is used to prepare solutions with a particular content. Doing this, the substance must not be weighed-out to a particular value in order to obtain the preselected content but the 725 Dosimat dispenses the amount of solvent calculated correspondingly.

Standard parameters:



expelling rate

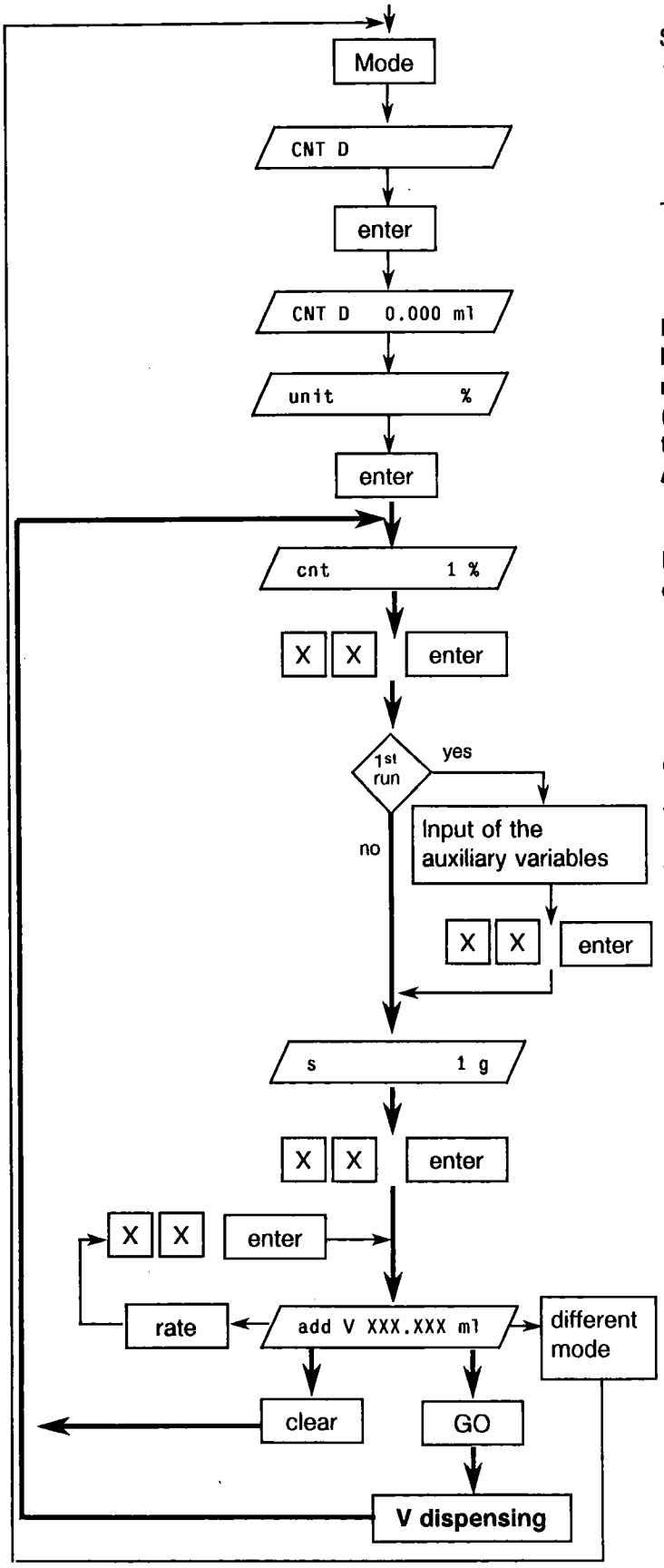
input range, see page 6

filling rate

Content entries which can be implemented in the CNT D mode are summarized below and designated with

Specified quantity (numerator) \ Reference quantity (denominator)	**Concentration** Volume of the solution V / L	**Fraction** Sum of the components j	**Molality** Mass of the solvent m_k / kg
Amount of substance n_i / mol	**Amount-of-substance concentration *c*** $c_i = n_i / V$ Units: mol/L, mmol/L Example: c(NaOH) = 0.1 mol/L Outdated: molarity, molar	**Amount-of-substance fraction *x*** $x_i = n_i / \Sigma n_j$ Unit: 1 Example: *x*(Au) = 0.005 Outdated: mole fraction, mole percent	**Molality *b*** $b_i = n_i / m_k$ Unit: mol/kg, mmol/kg Example: *b*(KOH, in EtOH) = 1 mol/kg
Mass m_i / kg	**Mass concentration ρ** $\rho_i = m_i / V$ Units: g/L, mg/L Example: $\rho(Pb^{2+})$ = 1 g/L Outdated: mg%	**Mass fraction *w*** $w_i = m_i / \Sigma m_j$ Units: %, ppm; 1 Example: $w(H_2O)$ = 5% Outdated: weight percent	

The operating sequence in the CNT D mode is as follows:



Selection of mode CNT D via key <mode> or <recall>

Transfer of mode CNT D

Following content units can be selected with key <unit>: %, ppm, g/l, mg/l, mol/l, mmol/l, mol/kg, mmol/kg.
(On the basis of the inputted unit, branching to the appropriate calculation formula for add V occurs.)

Input of the desired numerical value for the content.

Inquiry regarding the auxiliary variables is dependent on the selected unit:

- M 1 g/mol — molar mass of the substance
- dens. 1 g/ml — density of the solvent
- f= 1.00000 — factor, e.g. for ionic standards, volume contraction, etc.

Input of the weighing

Calculated volume is displayed and dispensed with <GO>.
With <clear> the values for "cnt" and/or "s" can be changed (→ gives an idea of the approximate weighing!).
The dosing rate <rate> and the mode <mode> can be altered.

Example: You need an EDTA solution with c (EDTA) = 0.1 mol/l.

Select the CNT D mode and transfer it to the working memory with <enter>.

The display shows CNT D 0.000 ml.

The following then appears automatically unit %.

Select the unit "mol/l": Press key <unit> several times until unit mol/l *appears in the display and accept the unit with <enter>.*

The display shows cnt 1 mol/l.

Input the value 0.1: <.> <1> <enter>.

The molar mass M is then requested: M 1 g/mol.

Enter the molar mass of $Na_2EDTA \cdot 2H_2O$:
<3><7><2> <.> <2><5> <enter>.

The display now shows f= 1.00000.

The factor for the volume contraction has been determined experimentally and is 0.981, see page 19.
Input of <.><9><8><1> <enter>.

The weighing is now requested. The display shows s 1 g.

Since you still do not have an idea of the magnitude of the weighing, accept 1 g for the time being: press <enter>.

The display shows the calculated volume add V 26.354 ml.

In this case, however, you need more of this solution and you thus want to weigh out more EDTA.

Press <clear>.

The display shows cnt 0.1 mol/l

There remains the inquiry regarding the auxiliary variables, and immediately after <enter> the display s 1 g *appears.*

If you input 5 g, the volume to be dosed is calculated add V 131.766 ml *etc.*

If you have established the approximate weighing, weigh out approximately the same amount of EDTA and input the exact value of the weight.

The display shows the calculated volume once more, but now you can dispense this with <GO>.

The formulae for calculation of the volume to be dispensed "add V" are shown in the following table, with

cnt	content in the selected unit
M	molar mass of substance to be weighed out
f	factor
dens	density of the solvent
s	weight of substance

	Unit	Computational formula add V =
Amount-of-substance concentration	mol/l	$\frac{f \cdot s \cdot 10^3}{cnt \cdot M}$
	mmol/l	$\frac{f \cdot s \cdot 10^6}{cnt \cdot M}$
Mass concentration	g/l	$\frac{f \cdot s \cdot 10^3}{cnt}$
	mg/l	$\frac{f \cdot s \cdot 10^6}{cnt}$
Mass fraction	%	$\frac{f \cdot s \cdot (10^2 - cnt)}{cnt \cdot dens}$
	ppm	$\frac{f \cdot s \cdot (10^6 - cnt)}{cnt \cdot dens}$
Molality	mol/kg	$\frac{s \cdot 10^3}{cnt \cdot M \cdot dens}$
	mmol/kg	$\frac{s \cdot 10^6}{cnt \cdot M \cdot dens}$

Applications of factor f

Factor f for ionic standards

With ionic standards, the mass fraction of a single ion A is usually specified. On the other hand, the solution is prepared from A_nB_m, e.g. a standard of 10 ppm Pb^{2+} prepared from $Pb(NO_3)_2$. The factor f is calculated from the formula:

$$f = \frac{n \cdot M(A)}{M(A_nB_m)} \quad \text{resp.} \quad f = \frac{m \cdot M(B)}{M(A_nB_m)}$$

where M(A): molar mass of ion A
M(B): molar mass of ion B
$M(A_nB_m)$: molar mass of substance A_nB_m

Example: *You wish to prepare a 5 % aqueous Cl-solution from NaCl.*

Inputs for the auxiliary variables:

f *0.60666*

dens. *0.98704 g/ml (water at 25 °C)*

The following table shows several factors for the most common ionic standards.

Cation	Standard prepared from:	Factor f	Anion	Standard prepared from:	Factor f
Na^+	NaCl $NaNO_3$	0.39339 0.27050	F^-	NaF	0.45245
K^+	KCl KNO_3	0.52441 0.38670	Cl^-	NaCl KCl	0.60666 0.47550
Ca^{2+}	$CaCl_2$	0.36111	Br^-	$NaBr \cdot 2H_2O$ KBr	0.57514 0.67141
Ba^{2+}	$BaCl_2 \cdot 2H_2O$ $Ba(NO_3)_2$	0.56222 0.52550	I^-	KI	0.76444
Cu^{2+}	$Cu(ClO_4)_2$ $Cu(NO_3)_2 \cdot 6H_2O$	0.24214 0.21494	SO_4^{2-}	K_2SO_4	0.55087
Pb^{2+}	$Pb(ClO_4)_2 \cdot 3H_2O$ $Pb(NO_3)_2$	0.45028 0.62557	NO_3^-	$NaNO_3$ KNO_3	0.72950 0.61319
			PO_4^{3-}	$Na_2HPO_4 \cdot 12H_2O$ $Na_3PO_4 \cdot 12H_2O$	0.26519 0.24985

The factor f as correction for substances with admixtures

e.g. water of crystallization, impurities, moisture.

The factor f as correction for the volume contraction

In the cases of the amount-of-substance concentration c (units mol/l and mmol/l) and the mass concentration ρ (units g/l and mg/l), the concentration is referred to the volume of the *solution*.

$$c_i = n_i/V \quad \text{resp.} \quad \rho i = mi/V$$

where n_i amount of substance i
m_i mass of substance i
V volume of the *solution*

Since the volume of the *solvent* V_0 is dispensed in the operational method of the CNT D mode, higher concentrations require a correction factor which takes the difference between V_0 and V (volume of the solution) into consideration:

$$f = \frac{V_0}{V}$$

This factor can be determined with the Dosimat in the DOS mode:
A solution of the desired concentration is prepared in the conventional manner in a volumetric flask by dispensing the solvent with the aid of the Dosimat up to the mark of the flask (V_0). If the volume V of the volumetric flask is inputted in the calculation parameter "s", the factor f is calculated directly by the Dosimat and appears on the display.
The factor f determined in this manner holds for the appropriate substance/solvent pair in the measured concentration range with the possibility of linear extrapolations up to concentrations of ca. 1 mol/l.

Several correction factors are shown in the following table:

Concentration c / Substance/solvent	0.05 mol/l	0.1 mol/l	1 mol/l
Potassium hydrogen phthalate/water	0.999	0.998	0.982
$Na_2EDTA \cdot 2H_2O$/water	0.991	0.981	–
NaCl/water	0.999	0.998	0.982
KNO_3/water	0.998	0.997	0.960
$CuSO_4 \cdot 5H_2O$/water	0.995	0.992	0.904

2.3. User memory

Up to 10 modes, complete with their user selected, specific parameters, can be stored in the user memory.

The relation of the different memories is shown in Fig. 2.1:

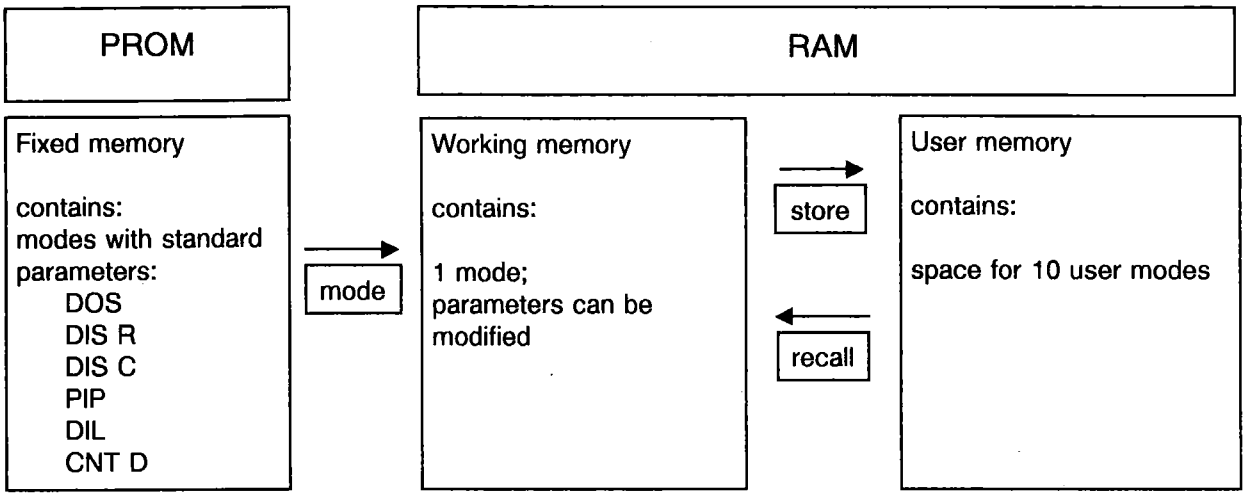
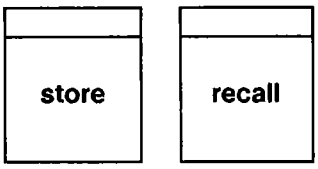


Fig. 2.1



The management of the user memory is carried out by means of the keys <store> and <recall>:

<store> <X> <enter>	Storing a mode at address X (X = 0,1...9).
<recall> <X> <enter>	Loading a mode from the user memory into the working memory.

Ex factory, the standard modes are stored in the user memory.

Example:
For different titrations you need mode DOS with different calculation parameters for result calculation.

1st Titration: Determination of Cl⁻ (table salt)

Calculation:	*Result in g/l*	=	*volume dosed * 5.85 / 25*
Calculation values:	*factor*	=	*5.85*
	smpl	=	*25 (sample size = 25 ml)*
	unit	=	*g/l*

Store this mode as mode 1 in the user memory:
Press <store><1><enter>.

2nd Titration: Determination of N

Calculation:	*Result in %*	=	*volume dosed * 0.14 /sample size*
Calculation values:	*factor*	=	*0.14*
	unit	=	*%*

Store this mode under address 2 in the user memory:
Press <store><2><enter>.

Put the parameters of the stored modes on your user memory card in order to always have a list of the contents of your user memory:

Metrohm — User Memory

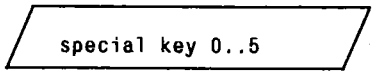
Nr.	Mode	V-DIS/ V-PIP ml	V-LIM/ V-DIL ml	↑ ml/min	↓ ml/min	Calculation
0						
1	DOS		OFF	analog	max.	f=5.85 s=25 g/l
2	DOS		"	"	"	f=0.14 %
3						
4						
5						
6						
7						
8						
9						

6.2242.000

Write on your user memory card either with lead-pencil or with waterproof felt-tip pen, and erase your entries with an eraser.

2.4. Special settings

Special settings can be executed by pressing key <0> during switching on the Dosimat.
Then the blinking display



appears.

Only keys <0> and <3> are significant.

Pressing key <CLEAR> once, leads back to the blinking display special key 0..5 and pressing key <CLEAR> again leads to the corresponding mode in the working memory.

Pressing key <GO> , the next inquiry is displayed.

Key	Display	Explanation
< 0 >	Prog 020 DD 010	Display of program number
< 3 >	auto fill on	Automatical refilling in mode "DOS" if more than one burette volume has been expelled. (on = yes; off = no; press <GO> until the right answer is displayed and store with <enter>)

3. Error messages, troubleshooting

3.1. Special messages and error messages

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

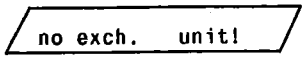
General error message:

blinking value	The value keyed in is out of the input range (see page 55).

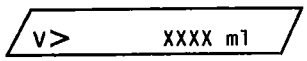
The following list of error messages is alphabetical:

cylinder empty!	The Dosimat is set to /auto fill off/ and one burette volume has been expelled in mode DOS. Exit: <FILL>
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 with display /DOS 0.000 ml/ (see also page 36) Note: Stored user modes will be cleared on re-initialising of the RAM and standard mode DOS is loaded into the working memory.
INF	In mode DOS, a result has been calculated with s = 0. Exit: <CLEAR>
NaN	(Not a Number.) In mode DOS, a result has been calculated with s = 0 and f = 0. Exit: <CLEAR>

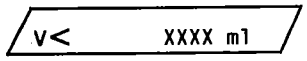
Call METROHM service



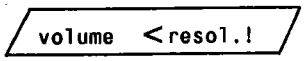
Exchange unit is not (properly) mounted.
Exit: Mount exchange unit properly.
Note: Filling or aspirating rate is set to maximum.



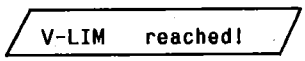
In mode CNT D the volume to be dosed is >999.999 ml.
Exit: <CLEAR> and enter new weight.



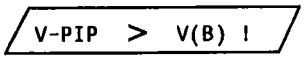
In mode CNT D the volume to be dosed is smaller than the smallest possible increment which can be dosed with the exchange unit mounted.
Exit: <CLEAR> and enter new weight.



The volume to be expelled is smaller than the resolution of the burette with the exchange unit mounted on the Dosimat.
Exit: Change volume to a value which can be expelled with the exchange unit mounted on the Dosimat
or
mount an exchange unit where the volume can be expelled .



Security volume is reached.
Exit: <FILL>



The stored pipetting volume is higher than the burette volume of the exchange unit mounted on the Dosimat (see input range for V-PIP, page 11).
Exit: Change volume to a value which can be expelled with the exchange unit mounted on the Dosimat
or
mount an exchange unit where the volume can be expelled.

3.2. Diagnosis

The 725 Dosimat is an extremly 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, to 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 and programme number (see special keys) of the instrument. If displayed, also state the fault indication.

(Note: If the key board 6.2124.100 or 6.2124.000 is not available, only items 8 and 9 of these instructions can be carried out.)

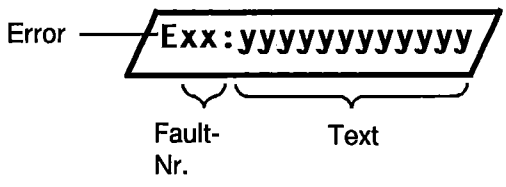
Procedure

- Carry out the test steps in order and check 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 is should be, the instrument is likely to be defective.
- Sections underlined in broken lines mean that they are displayed in flashing mode.
- The diagnosis steps denoted by a triangle ▶ can be used as re-entry points for repetitions provided the display shows:

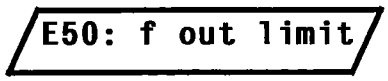
If the above message is not in the display press <CLEAR> key (perhaps serveral times)

If necessary switch power off and, after a few seconds, on again. Simultaneously press key <9> until the display shows 'diagn. key 0...7' .

- If <CLEAR> is pressed while the display shows 'diagn. key 0...7' the instrument is switched back to the Dosimat programme. To re-assume diagnosis, proceed as described above.
- Fault indication: A fault is displayed in the following way:



Example:



- 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:

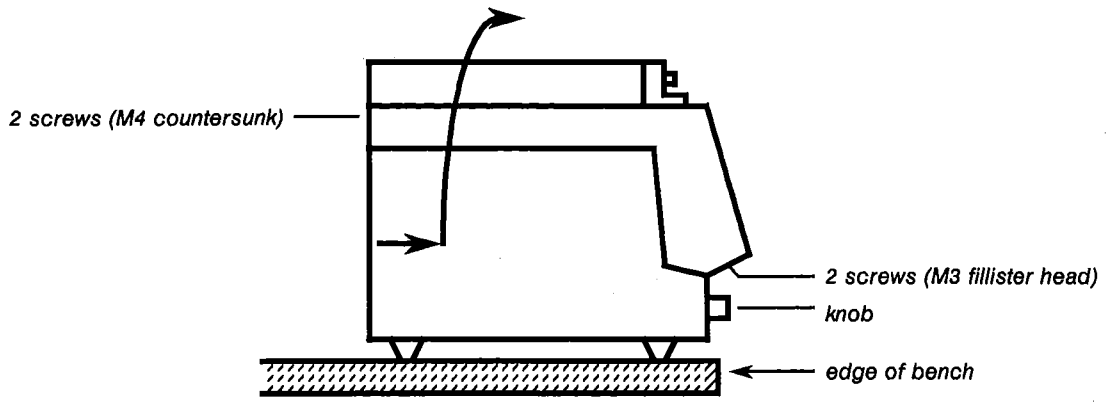


Fig. 1

- 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 off 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!**

- Displace the spindle from the mechanical stop by turning on the large gear wheel.
  (When the motor is inoperative, turn the spindle by hand into 0-position)

Regeneration of display

Under certain conditions the matrix points of the display may show differences in brightness. To regenerate the display, apply "Diagnosis of display" (item 4) and leave running group 1 until the 16 dotted patterns are displayed: stop with <5>. Keep this pattern displayed until the result is satisfactory.

Equipment required:

Exchange units if possible with different cylinder volumes (or dummy exchange unit 3.496.0070)

Stop watch or watch with second hand

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

Key board 6.2124.100 (or also 6.2124.000)

1. Connect key board

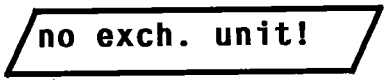
1.1 Disconnect stirrer. Remove exchange unit.

1.2 Power ON and simultaneously press key <9> (keep pressed until switch-on test pattern disappears)

➤ 2. Diagnosis of cylinder code

2.1 Press <0>

2.2 Press <GO>



2.3 Insert (dummy) exchange unit. *Install buret tip in order to feed back to the bottle (instead of drying tube).*

xx: check wether the displayed ml-code corresponds to the exchange unit.

Various exchange units can be inserted to verify their ml-code.

Fault indication:
If an exchange unit is coded incorrectly or if the code switches are inoperative, the display shows: E 90: ...no code!

2.4 Press <CLEAR>

➤ 3. Diagnosis of key board

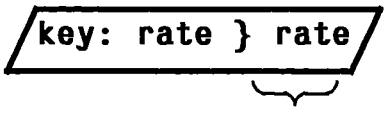
3.1 Press <1>

3.2 Press <GO> (or <enter>)

*

* With certain units " = " instead of "}" , see * at 4.2

The display requests to press a key on the keyboard 6.2124.100. (<rate>in this example) After pressing this key the respective key briefly appears in the right-hand side of the display (Example "Rate"):



for 50 ms

If the test is positive the next key to be pressed is displayed, etc. After pressing the last key (GO):

Fault indication:

a) *If the name of a pressed key is not displayed on the right-hand side (for 50 ms), the key is faulty or the respective signal path interrupted.*

b) *Display E 10: and on the right-hand side the name of a wrong key indicates a fault in the keyboard matrix, or the wrong key was pressed.*

A fault indication may be cancelled by pressing "CLEAR". "breaking off?" is then displayed, asking you whether you want to stop the test or not. To stop press <CLEAR>. To continue press <GO> until the display shows "key test end".

3.3 Press <CLEAR>

4. Diagnosis of display

4.1 Press <2>

4.2 Press <GO>

The characters are generated in 5 groups for an optical check of the display:

Group:

1) *All dots of the 7x5 matrix are displayed (item 7F in the table)*

2) *Display is blanked (about 1 s) (items 00 and 20 in the table)*

3) ** A chessboard pattern appears 16 times on the display. The pattern changes all 300 ms to its inverse character (according to 01 and 02 in the table)*

4) *The alphabet is displayed in capital letters the same letter being indicated 16 times; a change takes place in the same rhythm as above*

5) *The whole character composition is shown in endless moving picture (from 20...7F, 00...1F*)*

* It is possible that in some series display drivers with a reduced character composition are fitted. In this case the symbols " and ! are displayed alternately instead of the chessboard patterns. Moreover, the composition 00 to 1F in group 5 will not appear.

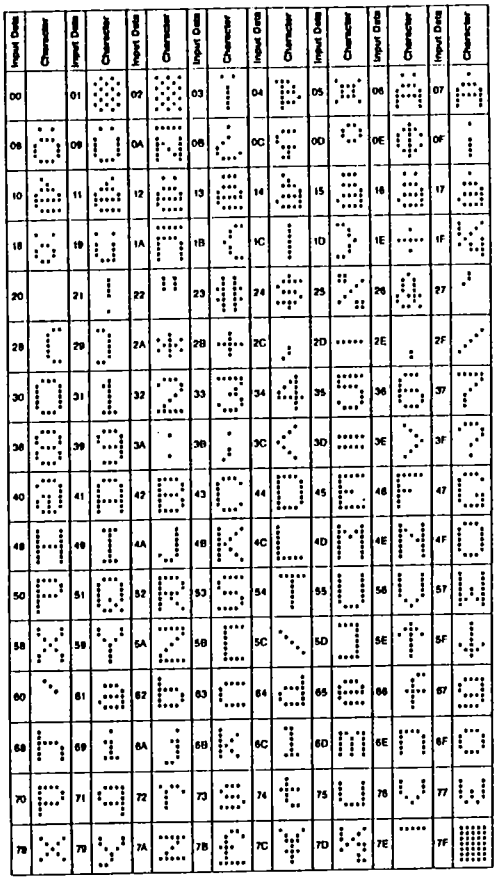
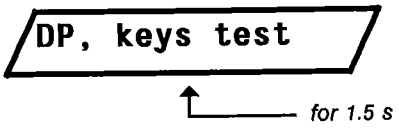


Fig. 2 Table of characters

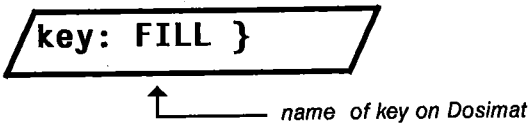
To stop the running test: press <5>
Restart the test: press <5> again
Breaking off a cycle in process (groups 1, 2, 4, 5) : (1×) <5>, <CLEAR> (the next group is displayed.)

(Group 3 can only be started and stopped.)
Group 5 is displayed endless, unless breaking off by <5> and <CLEAR> .

After breaking off group 5 there appears:



Afterwards:



Proceed as under 3.2, however pressing keys on Dosimat instead.

After breaking off group 5 there appears:

4.3 <CLEAR>

➢ 5. Diagnosis of digital timer

(The digital timer is that part of the electronic circuit in the dosimat which is responsable for the digital spindle speed rate.)

5.1 <4>

5.2 <GO>

The frequency of the digital timer is measured during 1.5 s. If the test is positive, the display shows o.k., otherwise E 50.

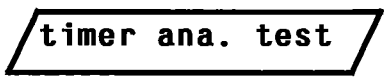
5.3 <CLEAR>

➢ 6. Diagnosis of analogue timer

[The analogue timer is that part of the electronic circuit in the dosimat which is responsable for the analogue spindle speed rate (adjustable with knob "dV/dt").]

6.1 Turn knob 'dV/dt' fully to the right

6.2 <5>



6.3 <GO>

The frequency of the analogue timer is measured during 1.5 s. If the test is positive, the display shows o.k., otherwise E 51.

6.4 <CLEAR>

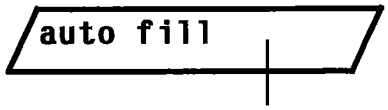
7. Diagnosis of spindle drive and cock changeover

7.1 Connect push-button cable 6.2107.000 (EA 858) (if available).

7.2 Power off
wait for 5 s

7.3 Power ON and simultaneously press <0> (keep pressed until dotted pattern disappears)

7.4 <3>



check wether display reads 'on' or 'off'
(make note!)

7.5 *Carry out only if auto fill 'on':*
(otherwise go on with item 7.6)

<GO>

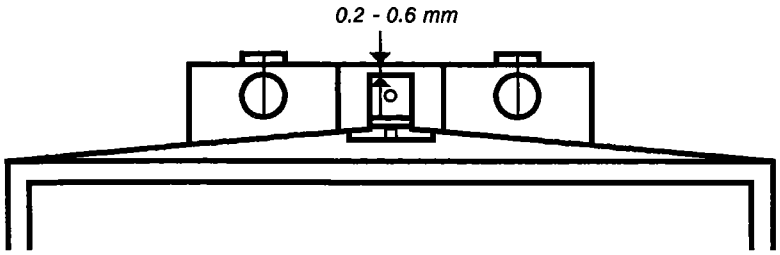
7.6 <enter>, <CLEAR>

The dotted pattern is displayed, afterwards the display changes to the mode used last before starting the diagnosis.

Dosimat fills.

7.7 Remove exchange unit

7.8 To check the spindle zero



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

7.9 The link piece of the cock coupling must be parallel to the side walls of the Dosimat.

7.10 Insert exchange unit again

Dosimat fills

Again the mode used last before starting the diagnosis appears in the display.

7.11 Actuate <mode> several times until the display reads

7.12 <enter>

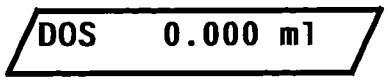
7.13 <rate>

7.14 <rate>

xx: (depending on exchange unit code)

7.15 <CLEAR>

7.16 <enter>



7.17 (Knob 'dV/dt' fully to the right)

7.18 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.

7.19

Spindle remains at top position.

The running time of the spindle is 20 s.

7.20 Measure the spindle height (can be performed only if dummy exchange unit 3.496.0070 is fitted, or the exchange unit removed and the locking switch (in the right-hand hole) carefully actuated by means of a screw driver).

The spindle moves 80 mm with respect to 7.8.

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

7.21 Actuate <FILL> and simultaneously take the time until the dosimat is in 'ready' position again.

Filling time:	one cock cycle	1 s
	filling	20 s

General rule:

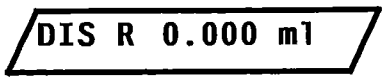
Spindle and cock must move in regular speed (observe sound!).

In the filling position the cock coupling must turn the lever of the exchange unit blamelessly to the left stop (almost without play and without jamming).

7.22 Turn potentiometer 'dV/dt' fully to the left

7.23 <mode>: select DIS R

7.24 <enter>



7.25 <Δ volume>

7.26 Depending on the exchange unit used, enter the volume as below:

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

7.27 <enter>

7.28 <GO> (depress briefly) and with a stop watch take the time until the cock starts turning. The time must be about 19 s (±5 s).

If under 7.4 the reading was "auto fill = **on**" set this parameter again according to items 7.2 to 7.6 .

End of test

Plug-in stirrer again.

Check stirrer functions.

Most of the functions of the 725 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 (see also page 24) did not reveal any fault, the endless RAM test can be carried out additionally (see item 8).

8. **Endless-RAM-test** (non-destructive)

(Can be performed also without key board 6.2124.100.)

8.1 Power off (wait 5 s)

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

8.3 <GO>

The processor now checks without destruction the ON-chip-RAM and the OFF chip-RAM of the 725 Dosimat. An 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

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

Dosimat fills
Display shows previous mode

Caution: Never leave the endless-RAM-test with "power off" but with <CLEAR>!

9. 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 8) or if repairs on the circuitry are carried out. This is indicated after "power on" with 'error 5'. The keyboard is then blocked, no entering is possible until the RAM is initialized again.

How to proceed

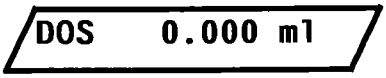
9.1 Power off (wait 5 s)
(all ext. connections removed!)

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

The RAM can also be initialized by means of the keyboard with 'Diagnose key 7'.

9.3 <GO>

9.4 <CLEAR>



(Dosimat fills)

The RAM-initialization deletes the data present in the USER-Memory and also those for the special functions and overwrites them with the standard data below:

The User- Memory is loaded with the standard modes.

Memory	0:	Mode	DOS
	1:		DIS R
	2:		DIS C
	3:		PIP *
	4:		DIL *
Memory	5:	Mode	DOS
	6:		DIS R

7:	DIS	C
8:	PIP	*
9:	DIL	*

The working memory is loaded with the standard mode DOS. The special functions of the dosimat are set to the following values:

analogue output scale:	1 stroke per 1000 mV
RS-232 sending:	off
Baudrate:	9600 Baud
auto. filling:	on

10. Liste of errors

E02...E04:	see	10.	endless-RAM-Test
E10:	see	3.	diagnosis of keyboard
E50:	see	5.	diagnosis of digital timer
E51:	see	6.	diagnosis of analogue timer
E90:	see	2.	diagnosis of cylinder code

11. Summary of the key allocation

(via key 9 at power on)

For repeated observations or special purpose it can be advantageous to enter directly at a certain test item. The following list gives an overview of the key allocation.

Key	0:	"cylinder code"	see	2.	Diagnosis of cylinder code
	1:	"keys test"	see	3.	Diagnosis of key board
	2:	"display test"	see	4.	Diagnosis of display
	4:	"timer dig. test"	see	5.	Diagnosis of digital timer
	5:	"timer ana. test"	see	6.	Diagnosis of analogue timer
	7:	"RAM init."	see	9.	RAM initialization

4. 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 ± ΔV (in ml)	Reproduciblity error accuracy ± ΔV (in ml)	Resolution of the display ΔV (in ml)
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	Reagent bottle
6.3012.XXX	5, 10, 20 ml With light protection and optional thermostatic jacket.	Ceramic. Automatic changeover.	Anti-diffusion.	1 l brown glass with thread. Reagent bottles from different manufacturers can be used directly.
6.3011.253	50 ml With light protection and optional thermostatic jacket.	Ceramic. Automatic changeover.	Normal.	1 l brown glass with thread. Reagent bottles from different manufacturers can be used directly.
6.3007.XXX	5, 10, 20 ml Brown and clear glass.	PTFE. Automatic changeover	Anti-diffusion.	1 l brown glass with SGJ.
6.3006.XXX	1, 5, 10, 20, 50 ml Brown and clear glass.	PTFE. Automatic changeover	Normal.	1 l brown glass with SGJ.
6.3005.XXX	5, 10, 20, 50 ml Brown and clear glass.	PTFE. Manual changeover	Normal.	1 l brown glass with SGJ.
6.3004.XXX	5, 10, 20, 50 ml Clear glass.	PTFE. Manual changeover	Normal.	500 ml PP.

4.1 Setting up 6.3011.XXX/6.3012.XXX Exchange Units

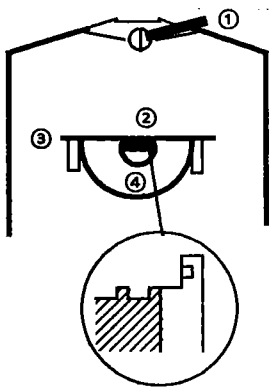


Fig. 4-1: Bottom view

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. 4-5, page 43.

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.

4.2 Assembly of other models

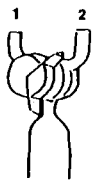
See also Fig. 4-6 to 4-4, pages 44-46
- The instrument without Exchange Unit is in the zero position.
- Mount Exchange Unit (without glass cylinder) from the front on the sliding plate and push right back.
- Allow piston spindle to run out by app. 2 cm.
- Carefully grease PTFE piston (see Section 4.5), 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

1 Connection to glass cylinder
2 Connection to burette tip
3 Connection to reagent bottle

Models 6.3004.XXX/6.3005.XXX



1 Connection to reagent bottle
2 Connection to burette tip

Fig. 4-2: 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.

4.3 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.

(- With manual cock changeover: set cock to "feed" position).

- Press <GO> key until the piston is in the top end position.

(- With manual cock changeover: set cock to "fill" 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.

4.4 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/6.3012.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.

4.5 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.
- With 6.3011.XXX and 6.3012.XXX Exchange Units, 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 of models 6.3012.XXX, 6.3011.XXX, 6.3007.XXX, and 6.3006.XXX

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 stocock:
- 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.
- nsert stopcock from above in the holder and press down until the quick-release coupling engages.
- Screw in screw nipples.

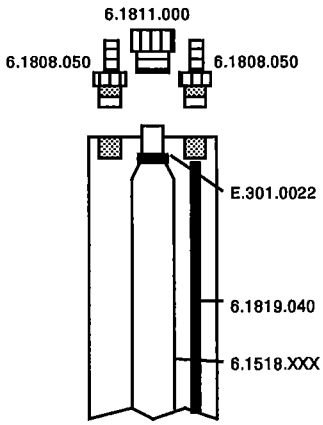
PTFE cock of models 6.3005.XXX and 6.3004.XXX

PTFE is subject to cold flow under load. For this reason the bore in the PTFE-plug is initially set high in relation to the holes in the glass barrel.
If the cock is slightly stiff either on receipt or after standind for a long period, gentle manipulation will readily free the plug. It should not be necessary to alter the setting of the retaining cap since this stiffnes results from the cold flow of PTFE.
If the cock is to be autoclaved, first slacken the key in the barrel and then re-tighten it before using the cock.

Glass cock of models 6.3005.XXX and 6.3004.XXX

Regular care pays off better than using excessive force and breaking the glass!
- It should be remembered that the nut is not intended as a tensioner, but simply to prevent the plug taper from working loose. If the nut is done up too tightly, the grease is squeezed off, and the cock will then jam.
- If the cock no longer turns smoothly, or if the grease is no longer evenly distributed over the sliding surface, the cock must be dismantled, cleaned and regreased.
- **Cleaning**: Wipe off old grease, clean cock with suitable solvent (e.g. acetone), rinse and dry.
- **Greasing**: Ensure that cock is clean and dry. Smear SISCO grease evenly over the ground surface of the cone, neither applying too little nor too much. Insert the cone axially in the sleeve, press lightly and turn slowly so as to expel air bubbles and spread the grease evenly: The contact surface should be transparent without any smear marks being visible. Fit the washer and the O-ring, and do up nut lightly.

4.6 Mounting the thermostat jacket of 6.3011.XXX/6.3012.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 4-3: Thermostat jacket

4.7 6.3006.113 Micro-model – 1 ml

Assembly:
See also Fig. 4-9, page 47
- 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

1 Connection to glass cylinder
2 Connection to burette tip
3 Connection to reagent bottle

Fig. 4-4: 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 knurles 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).

4.8 Ordering designations

4.8.1 Models 6.3012.XXX, 6.3011.XXX, 6.3007.XXX, and 6.3006.XXX

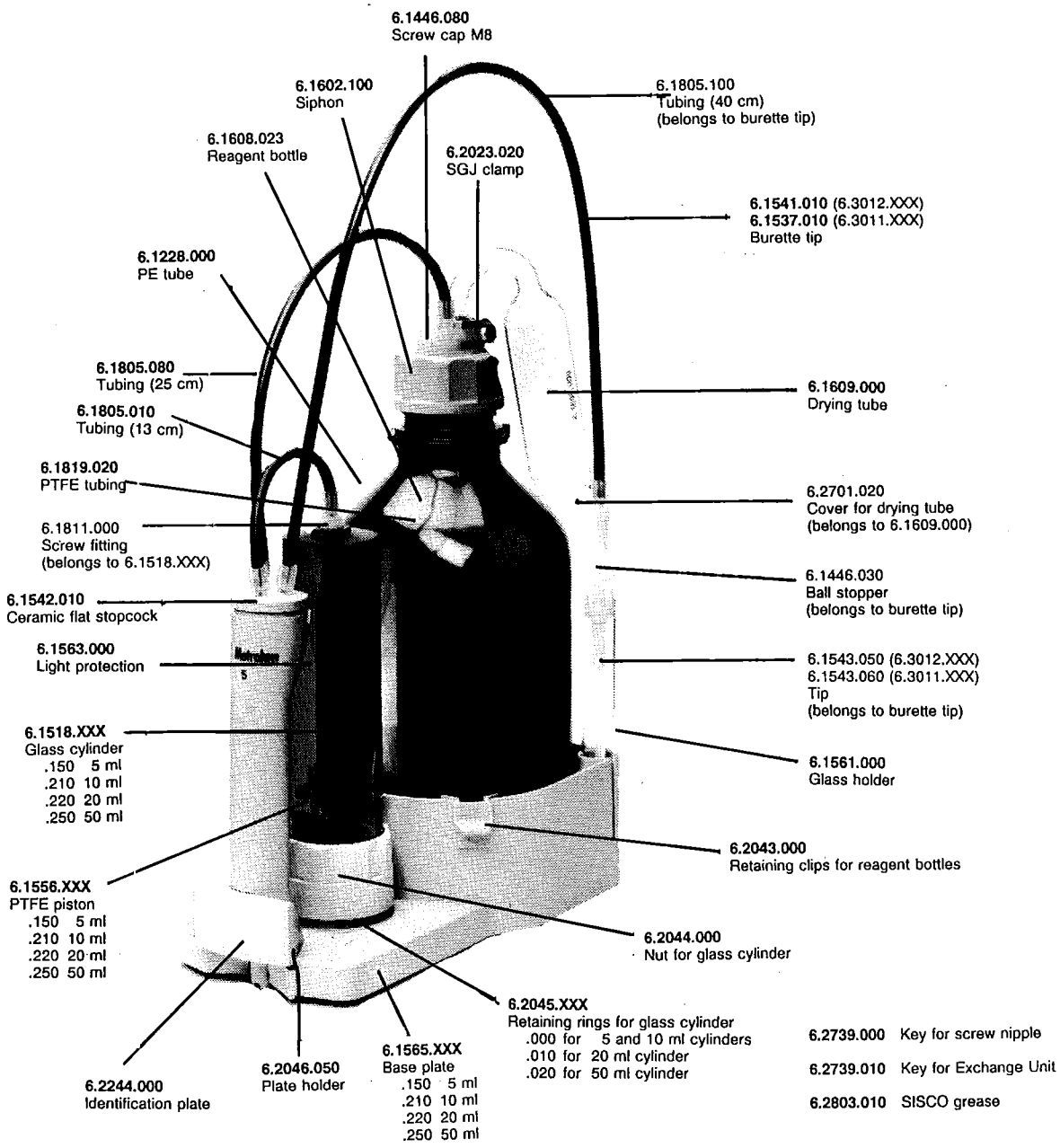


Fig. 4-5: Standard accessories and ordering designations for 6.3012.XXX and 6.3011.XXX Exchange Units

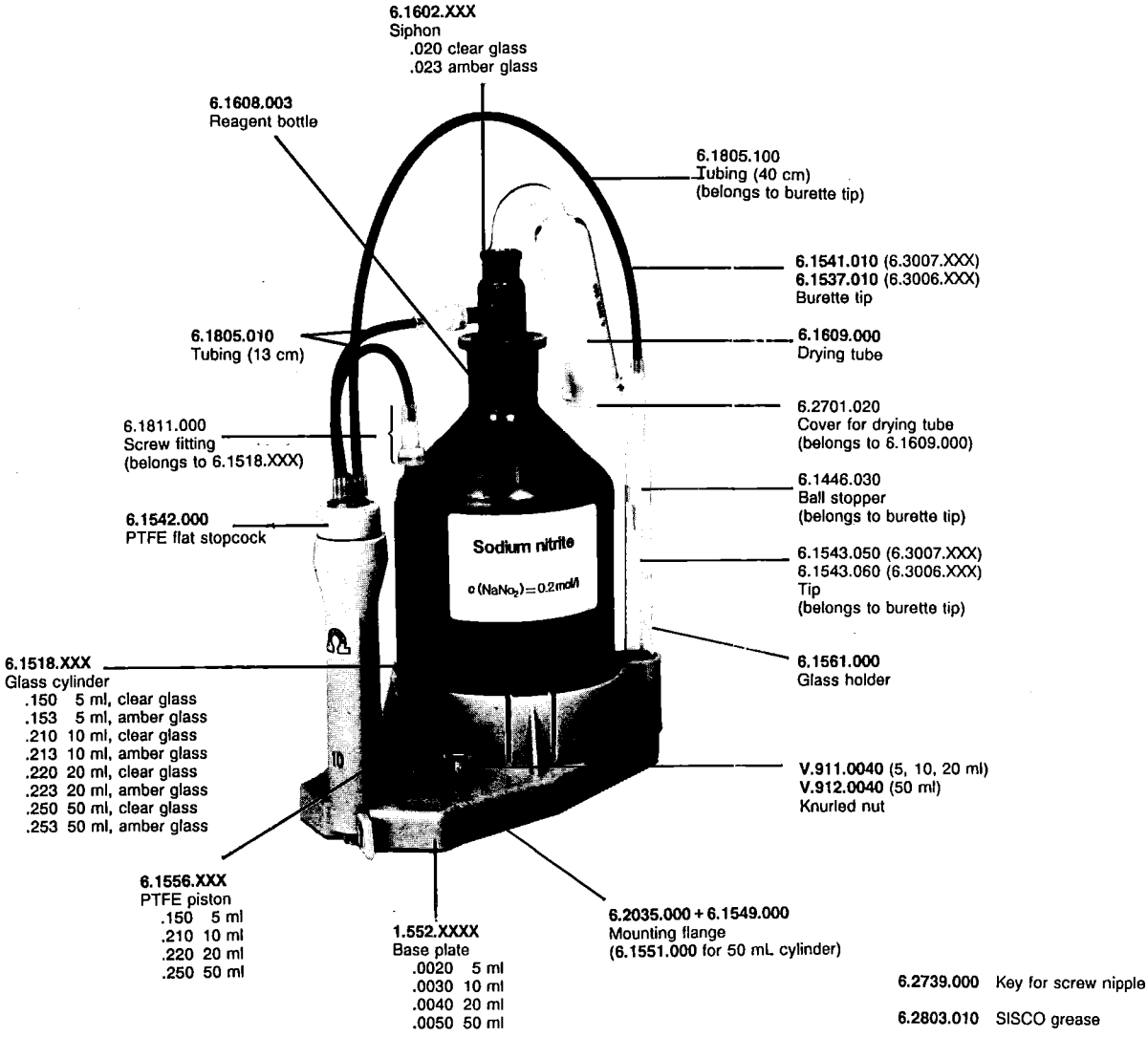


Fig. 4-6: Standard accessories and ordering designations for 6.3007.XXX and 6.3006.XXX Exchange Units

4.8.2 Models 6.3005.XXX and 6.3004.XXX

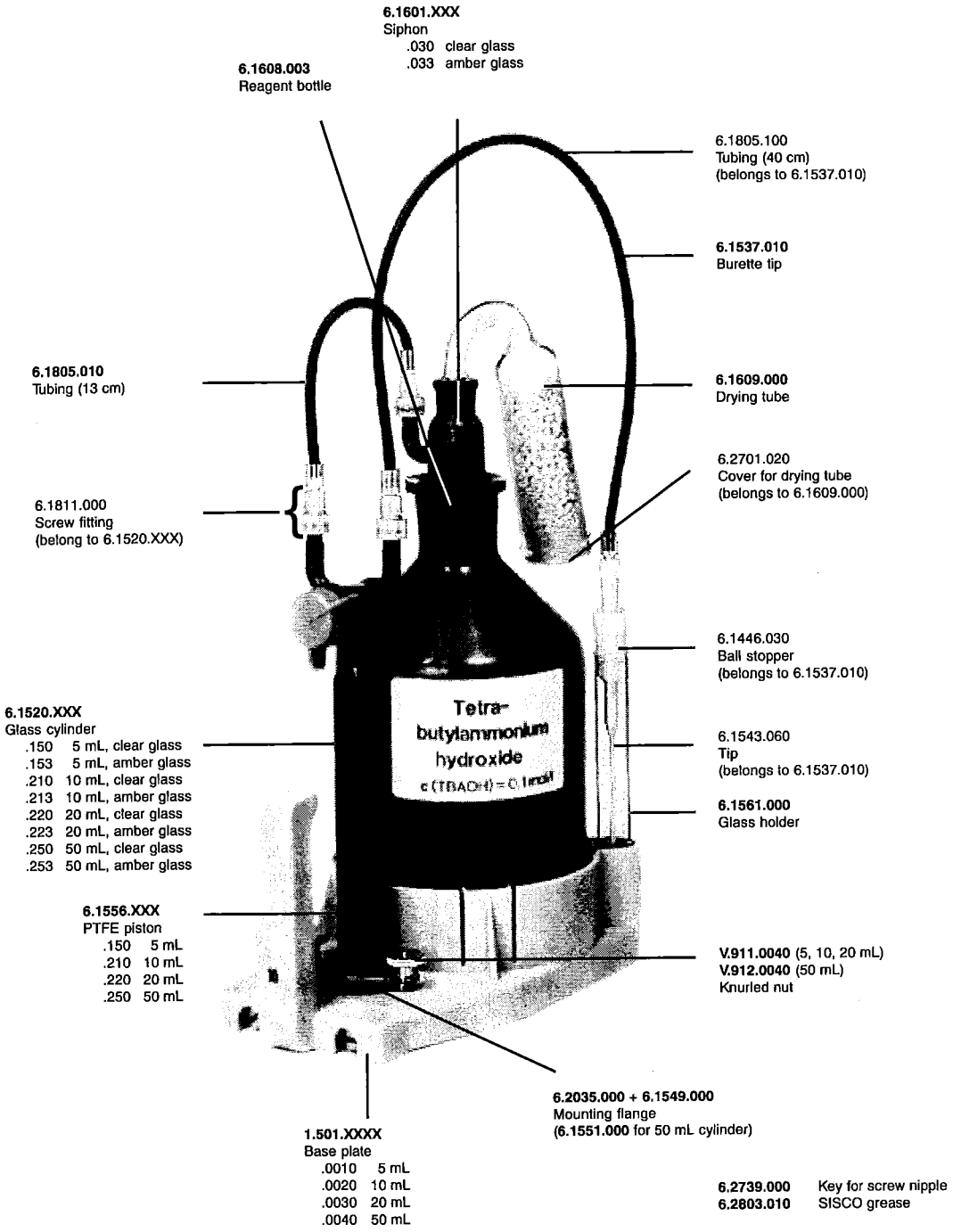


Fig .4-7: Standard accessories and ordering designations for 6.3005.XXX Exchange Units

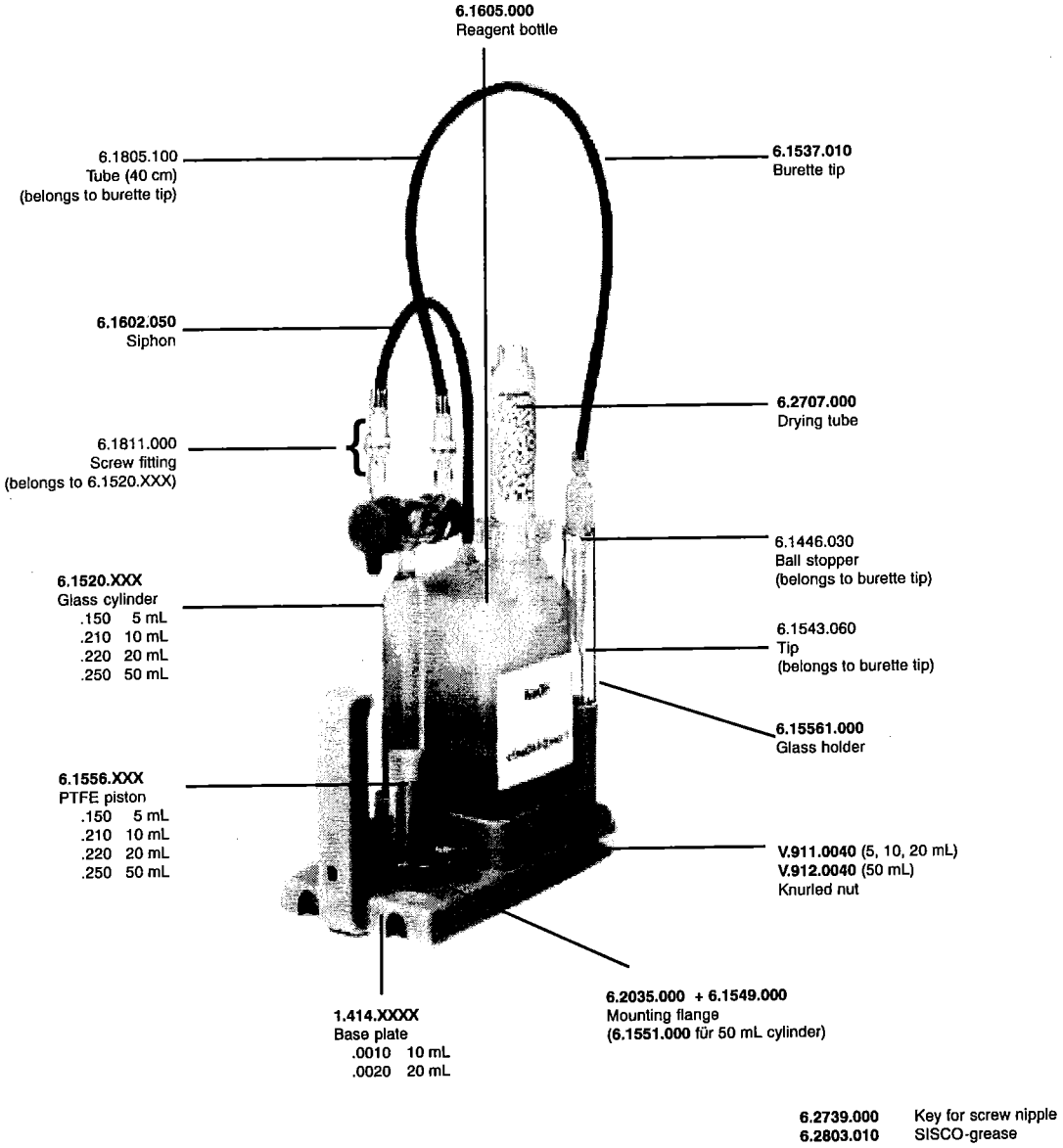


Fig. 4-8: Standard accessories and ordering designations for 6.3004.XXX Exchange Units

4.8.3 Micro-model – 1ml, 6.3006.113

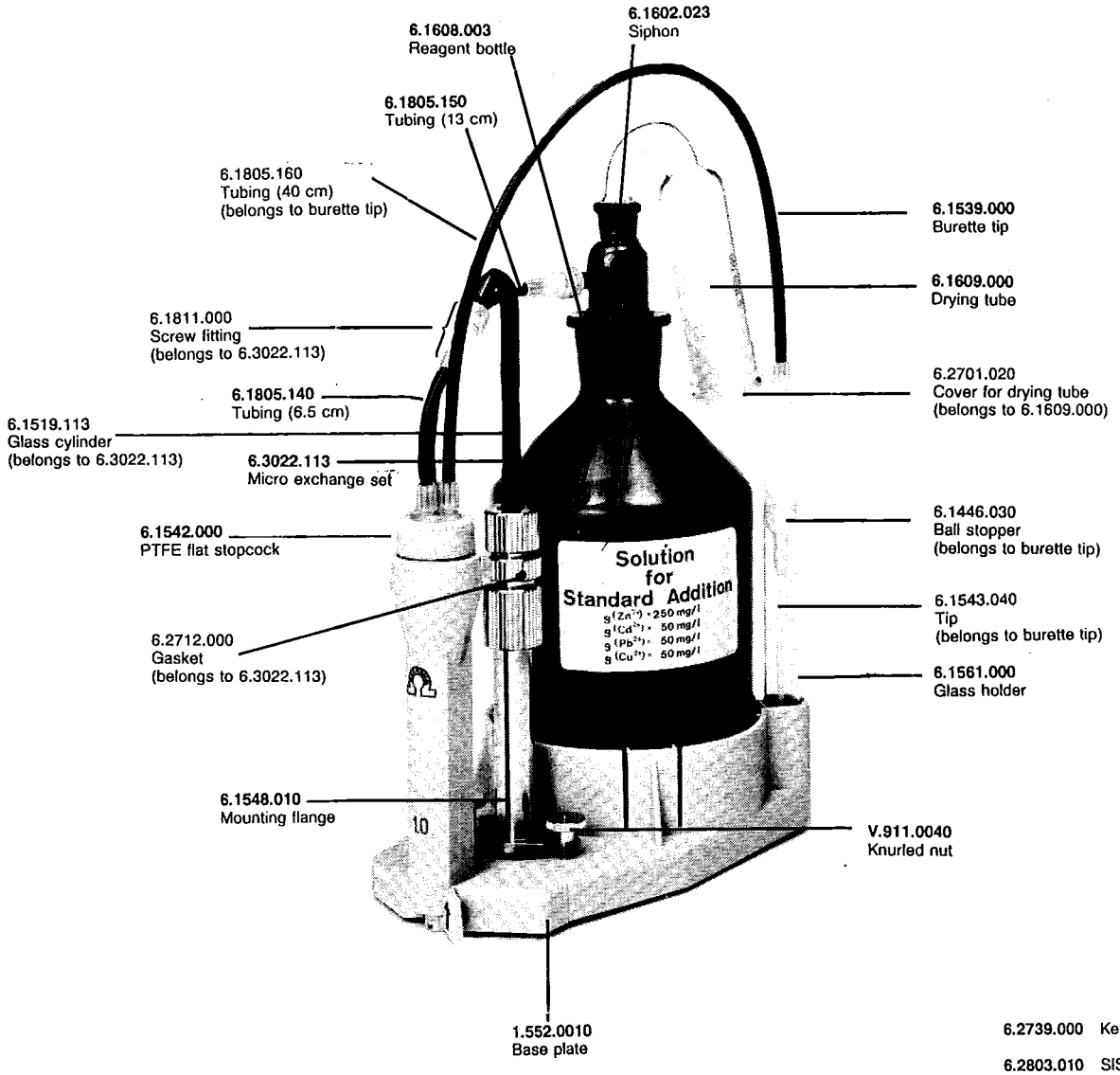


Fig. 4-9: Standard accessories and ordering designations for 6.3006.113 Exchange Unit

4.8.4 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
Amber glass bottle with GL 45 thread	6.1608.023
Bottle made of PP with ground-glass joint SGJ 29	6.1608.004
Siphon for bottles with SGJ 29	6.1602.023
Thread adapter 32 mm/GL 45	6.1618.000
Thread adapter 28 mm/GL 45	6.1618.010

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:

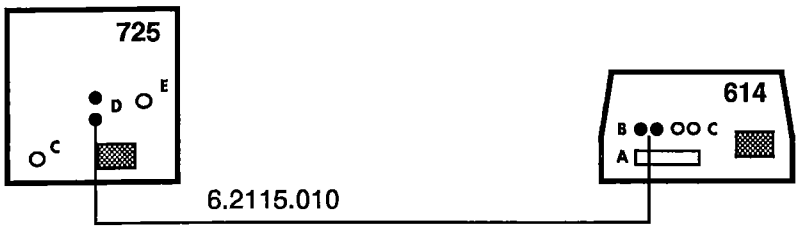
Earthing for burette tip	6.1808.030
Tip without anti-diffusion valve	6.1543.060
Tip with anti-diffusion valve	6.1543.050

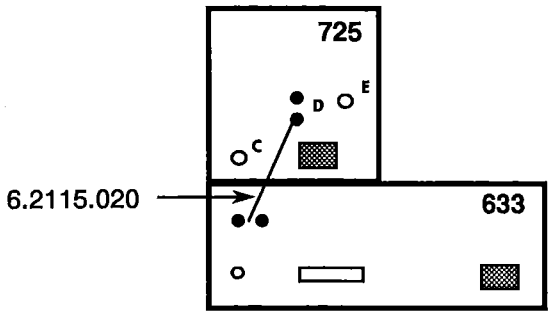
Miscellaneous:

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

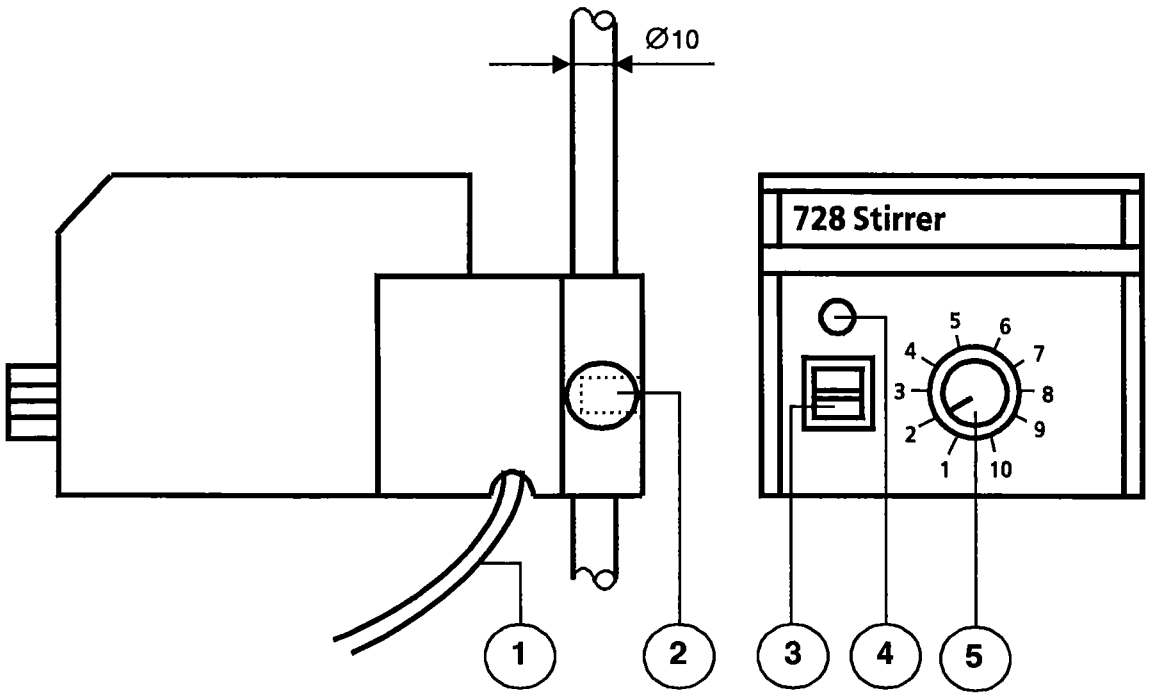
5. Appendix

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 Ø = 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, $n \approx 200$ ..... 1900 min^{-1} (without load)

Stirring bar — PTFE coating, magnetic core

	Length	Dimensions	Shape
6.1903.000	8 mm	Ø = 4 mm	O
6.1903.010	12 mm	Ø = 4 mm	O
6.1903.020	16 mm	Ø = 4 mm	O
6.1903.030	25 mm	Ø = 5 mm	O
6.1906.000	42 mm	-	Δ
6.1906.010	25 mm	-	Δ
6.1906.020	26 mm	-	oval

5.3 Technical specifications

Exchange units — 1, 5, 10, 20, 50 ml burette cylinder volumes, preferably with flat cock for automatic cock changeover

Resolution — 10'000 pulses per 100% of burette volume

Resolution and error for the different exchange units

$V_{cylinder}$ ml	Resolution of display µl	Absolute error µl	Reproducibility error µl
1	1	±3	±1
5	1	±15	±5
10	1	±20	±5
20	2	±30	±10
50	5	±50	±40

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

Operation
- Base functions — on 725 Dosimat
- Extended functions — with additional 6.2124.100 keyboard

Modes	
Dosing	DOS (with the ability to calculate a result from the dosed volume)
Repetitive Dispensing	DIS R
Cumulative Dispensing	DIS C
Pipetting	PIP
Diluting	DIL
Preparation of solutions with preselected content	CNT D
Data memory	non-volatile
User memory	for 10 complete user modes
Display	Vacuum fluorescence display (VFD), 16 characters
Materials	
Cabinet	Polybutylene terephthalate (PBTP)
Key cover	Polycarbonate (PC)
Temperature range	Ambient temperature +5... +40° Storage, transport -40... +70°
Safety specifications	The design and construction are in accordance with the safety specifications of IEC Publication 348, 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 The 6.5611.000 Pipetting equipment

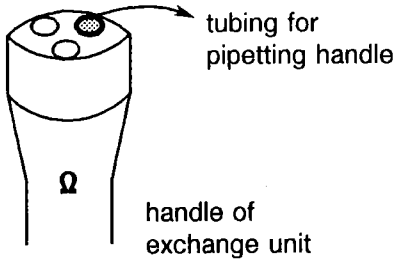
The 6.5611.000 pipetting equipment comprises the following parts:

1	Handle with 6.1562.020 pipetting tubing (3 ml, FEP*)	6.1562.000
1	Pipetting tubing (0.7 ml, FEP*)	6.1562.010
1	Pipetting tip (PP) for 6.1562.010 pipetting tubing, pack of ten	6.1562.030

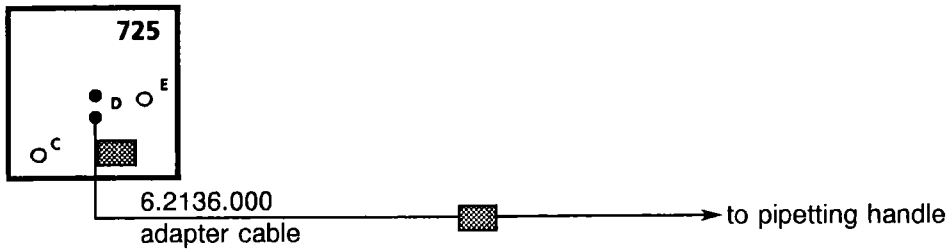
In addition you need the 6.2136.000 adapter cable.

*FEP: fluorinated polyethylene/propylene

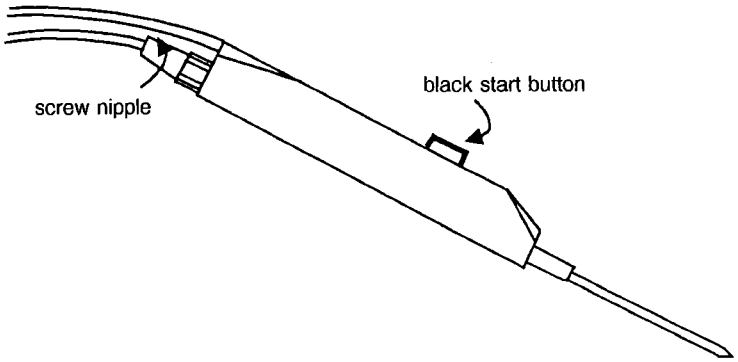
The tubing of the pipetting handle is attached to the exchange unit in place of the burette tip.



The cable of the pipetting handle is connected to the Dosimat:



The Dosimat can be started with the black button on the handle.
The angle between the tubing guide and the handle can be adjusted for fatigue-free working.



Important: The pipetting tubing must always be clean and free from kinks!

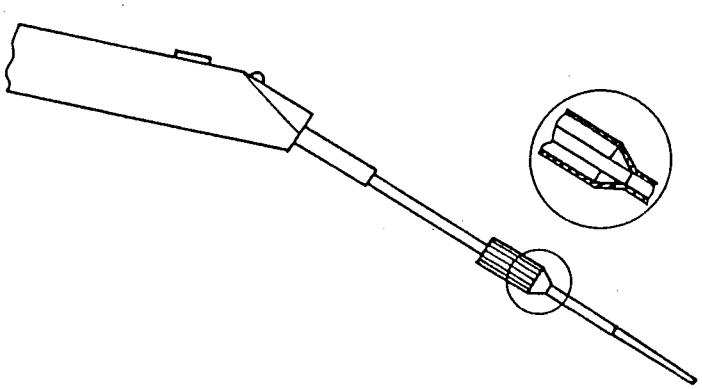
Changing the 6.1562.020 tubing (3 ml)

1. Undo all clips holding the cable and tubing together.
2. Loosen screw nipple and pull out old tubing.
3. Insert new tubing until the tip extends ca. 5 cm in front of the holder.
4. Tighten lightly screw nipple and secure clips to the cable.

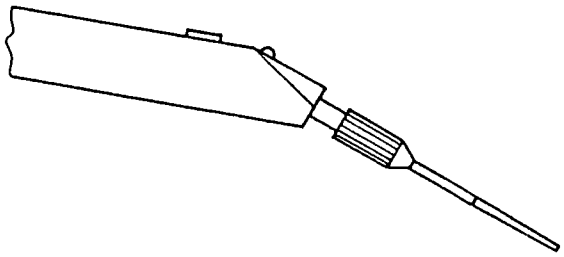
Using the 6.1562.010 tubing (0.7 ml)

1. Loosen screw nipple and insert 6.1562.010 tubing until the tip extends ca. 10 cm in front of the holder (a spacer ring must lie between the thread for the connection to the exchange unit and the splayed tubing end). The tubing should be cut off cleanly at right angles at the tip. If the tip of the tubing is damaged, it can be trimmed off with a razor blade. Cutting with scissors or a knife results in undesirable dead volumes!

2. Push 6.1562.030 tip over the tubing end and press well to ensure that the tubing end is seated firmly.



3. Push tip over the tubing guide at the handle, tighten lightly screw and secure cable clips.



5.5 Warranty

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 embedment 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.

5.6 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.

5.6.1 Instruments needed

- Dosimat.
- Exchange Unit with 6.1543.060 Burette Tip (without anti-diffusion valve), filled with dist. water free from CO_2 (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.

5.6.2 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 5.6.3.4).

5.6.3 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.

5.6.3.1 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:

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

where:

V_{actual}:	Discharged volume in mL, calculated from the weighing data
m_{read}:	Mass read off on the balance in g
ρ_L:	Density of the discharged liquid in g/mL
ρ_A:	Density of air in g/mL (density of dry air at 760 torr: ρ_A = 0.0012 g/mL)
ρ_S:	Density of the standard used to calibrate the balance in g/mL (for brass weights: ρ_S = 8.4 g/mL)

As an approximation for dist. water, the correction factors in the following table can be used (calculated with ρ_A = 0.0012 g/mL, calibration of the balance with brass weights ρ_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, 103rd edition, Walter de Gruyter-Verlag, 1985, page 126 ff).

Solution	Density $\rho_{20°C}$ g/mL	Concentration c mol/L
HCl	1.000	0.09874
	1.005	0.3749
	1.015	0.9393
	1.020	1.228
NaOH	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_{actual}.

5.6.3.2 Relative error

The relative error is calculated as follows:

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

V_{actual}: Discharged volume in mL calculated from the weighing data (formula 1)
V_{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 **METROHM**		Error limits according to **DIN**	
	Deviation from the nominal volume ± µL	**max. rel. error %**	Deviation from the nominal volume ± µL	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.

5.6.3.3 Linear regression

A linear regression of V_{actual} vs V_{set} is performed (use a pocket calculator or statistics program on a PC). Here, V_{actual} is entered as the y coordinate (dependent variable) and V_{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 µL < 3 x volume resolution of the Exchange Unit, i.e.

Nominal volume of the Exchange Unit mL	Resolution µL	**Intercept ± µL**
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:

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

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

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

where
x_i resp. y_i = individual measured value x (= V_{set}) resp. y (= V_{actual})
x_m resp. y_m = Media of x (= V_{set}) resp. y (= V_{actual})
Build sums over all measured values (i = 1...10)

5.6.3.4 Example for a 10 mL Exchange Unit

Temperature	23.5 °C
Atmospheric pressure	696 mm Hg
Dispensed liquid	Boiled dist. water
Density (from table)	0.9977417 g/mL
Calculation factor	1.0036527

Regression data

Slope	1.00104
Intercept	0.0016 mL = 1.6 µL
Correlation coefficient	0.999999945

V_{set} mL	Mass g	V_{actual} mL	$V_{actual} - V_{set}$ µL	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

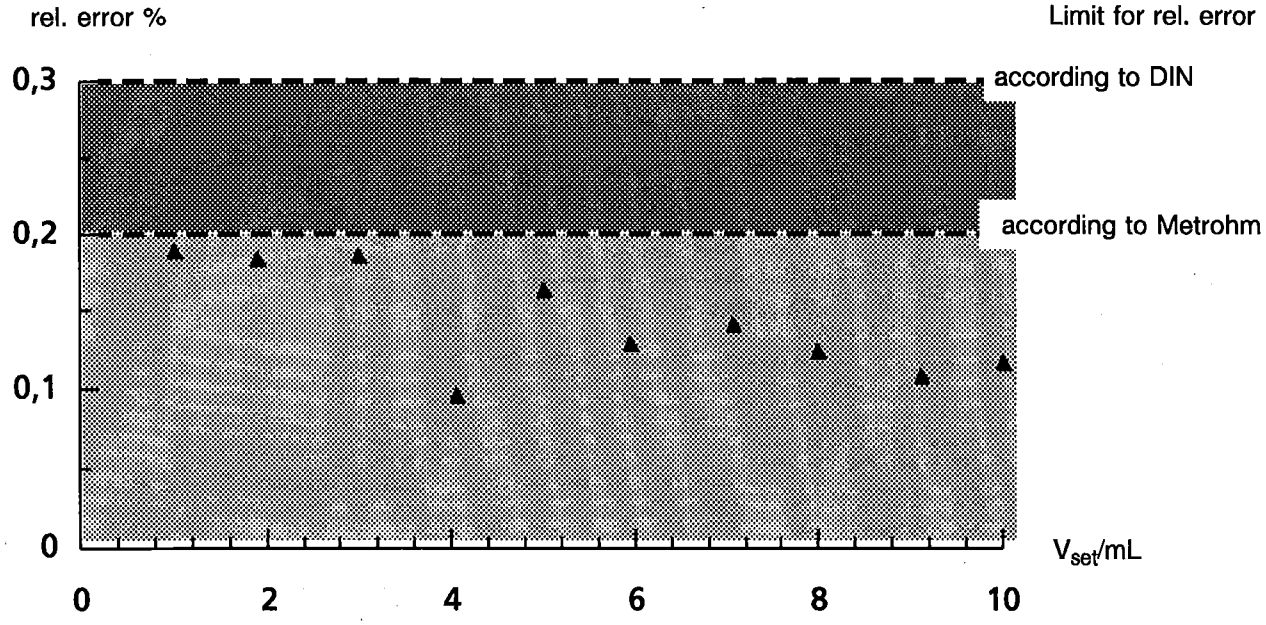
Calculation of the calculation factor and the first V_{actual} using formula 1):

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

where:

m_{read}: Mass read off on balance
ρ_L: Density of water at 23.5°C = 0.997417 g/mL
ρ_A: Density of dry air at 760 torr = 0.0012 g/mL
ρ_S: Density of brass calibration weights = 8.4 g/mL

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



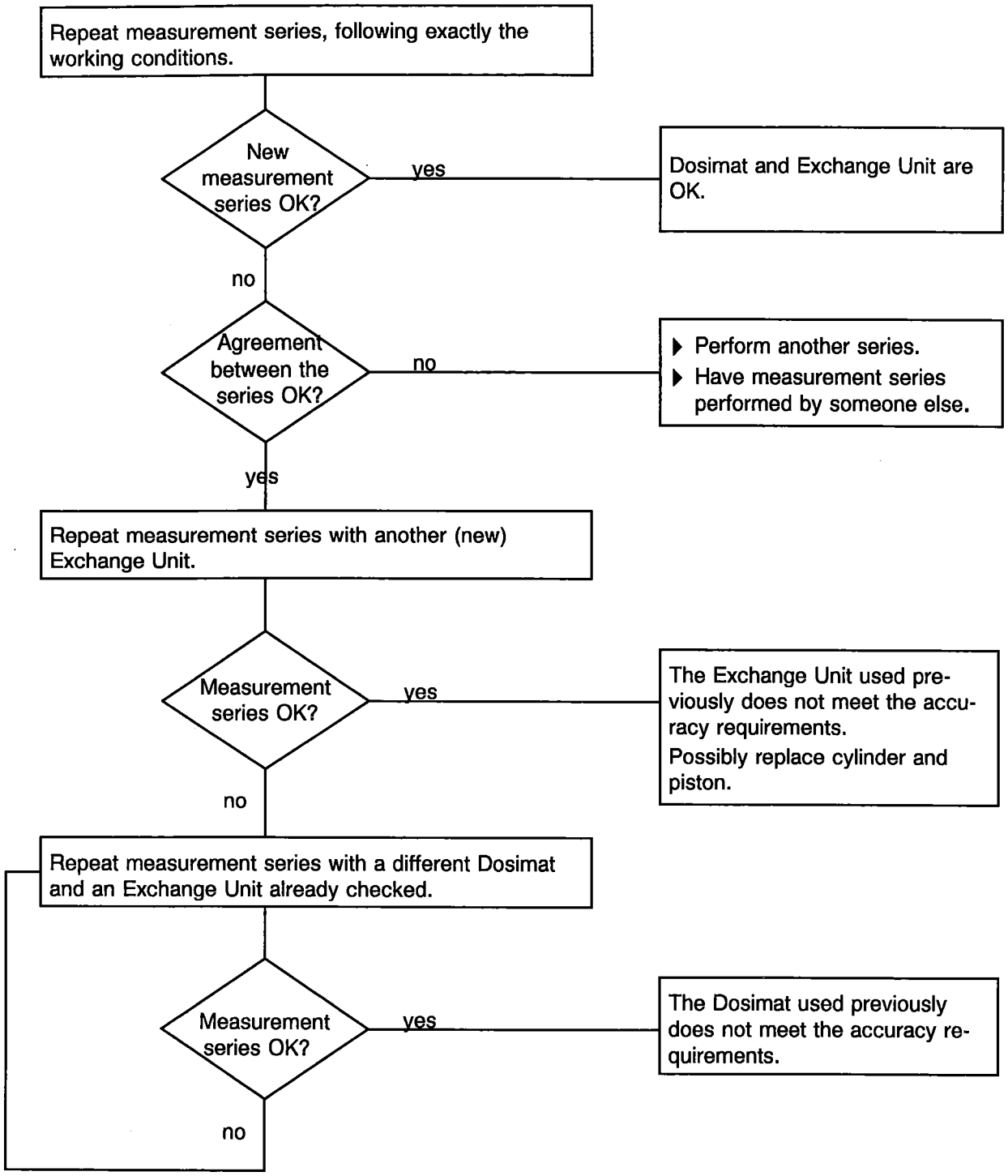
If you recalculate the example, the results of the linear regression may be slightly different from the values above due to different internal arithmetic resolutions on different calculators.

5.6.3.5 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).

5.6.4 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:



Test record for Dosimat with Exchange Unit

Operator .....

Date .....

Dosimat, ID ..... Type, serial number .....

Exchange Unit, ID .....

Nominal volume .....

Temperature .....

Atmospheric pressure .....

Dispensed liquid .....

Density .....

Calculation factor .....

V_{set} mL	Mass g	V_{actual} mL	$V_{actual} - V_{set}$ µL	rel. error %

V_{set} Volume set on Dosimat
Mass Mass read off on balance
V_{actual} Volume actually dispensed, calculated using formula 1)
$V_{actual} - V_{set}$ Deviation of the volume actually dispensed from the set volume

Regression data

Intercept .....

Slope .....

Correlation coefficient .....

5.7 Scope of delivery and ordering designations

725 Dosimat including the following accessories:	**2.725.0010**
1 x Push rod	6.2739.010
1 x Cable with manual feed push-button	6.2107.000
1 x Keyboard	6.2124.100
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	8.725.1013

Options

Exchange Units, see also chapter 4, eg. with automatic cock changeover and light protection

5 ml	6.3012.153
10 ml	6.3012.213
20 ml	6.3012.223
50 ml	6.3011.153

Stirrer, Ti-Stand

728 Magnetic Stirrer	2.728.0040
722 Rod Stirrer	2.722.0010
703 Ti Stand with Magnetic Stirrer and automatic aspiration unit	2.703.0010
727 Ti-Stand with rinsing unit	2.727.0010
727 Ti-Stand with Magnetic Stirrer and rinsing unit	2.727.0100

Cable for connection with Titrators

702, 716 Titrinos, Activate Puls	6.2139.000
702, 716 Titrinos, Activate Puls and 664 Control Unit to Exchange Unit	3.980.3610
614 Impulsomat	6.2115.010
633 KF-Automat	6.2115.020

Various accessories

Pipetting equipment	6.5611.000
Adapter cable for pipetting equipment	6.2136.000
Cable with manual feed push-button, length: 1 m	6.2107.000
Cable with foot feed switch, length: 2 m	6.2107.010
Card for managing the user memory	6.2242.000

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Displays are designated with /_____/, keys with < >

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CE

Metrohm

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EC Declaration of Conformity

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

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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:

Universal dispenser for liquid handling in laboratories; a dosing device for titrators.

Herisau, December 6, 1995

Dr. J. Frank	Ch. Buchmann
Development Manager	Production and Quality Assurance Manager