METROHM Ltd. CH-9100 Herisau (Switzerland)

Dosimat 665

Series 14 ...

8.665.1023

93.08 Ti/gg

Metrohm Short operating guide 665 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	.001...150 ml/min; OFF
	↓	Filling rate	max.	.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

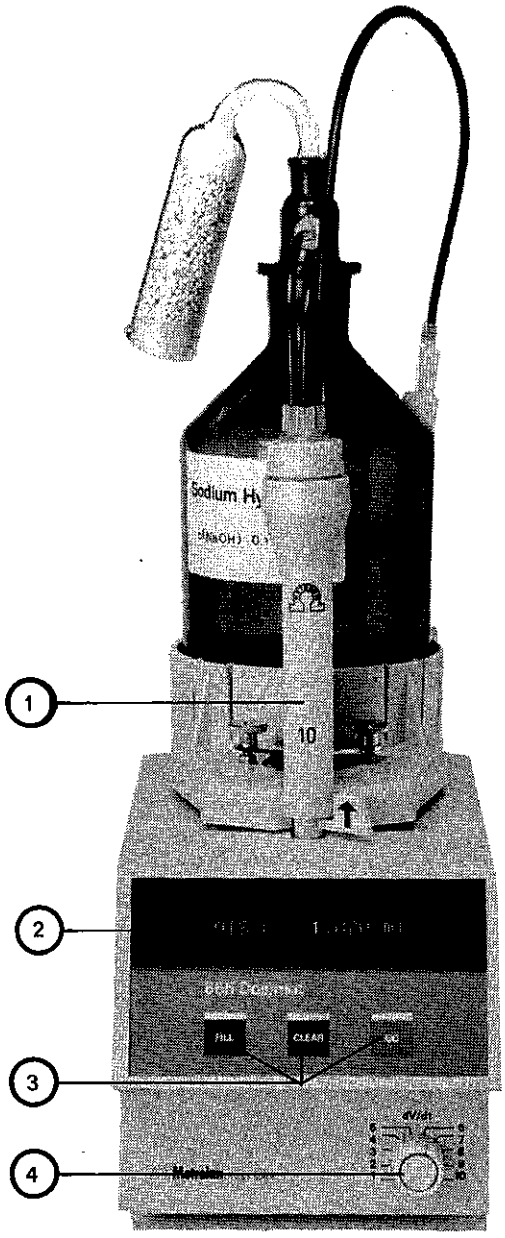
Instructions for use
665 Dosimat

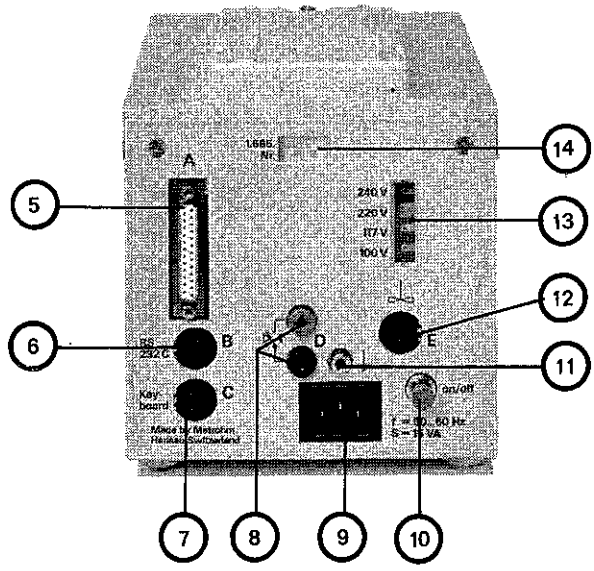
Contents

Explanation of symbols:

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

 means "display"


Sodium Hy
10
FILL
CLEAR
dV/dt
1
2
3
4


A
B
C
D
E
RS 232 C
Key-board
on/off
5
6
7
8
9
10
11
12
13
14

1. Operating elements on the 665 Dosimat and their function

(1) Exchange unit

Normally 6.3006.XXX or 6.3007.XXX 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 (with remote control off) 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).
Without keyboard, the filling rate is set to maximum (digitally controlled) and is therefore independant of the analogue setting.

(5) Data inputs and outputs

Via data transfer interface according to RS 232 C including optional analogue output.
For 25-pin D subminature plug.
Important: Note plug position, pages 60 ff!

6 **Data inputs and outputs**

Via data transfer interface according to RS 232 C. For 8-pin plug.
(For details see page 60ff).

7 **Connection for keyboard**

(For details of operation with 6.2124.000 keyboard see page 4ff).

8 **Connection for external dosing contact**

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

9 **Mains connection**

In power supply systems, in which strong HF interferences (transients) are superimposed on the mains voltage, the 665 Dosimat should be connected via an additional powerline filter, e.g. METROHM 615 model.

10 **Main switch**

Switching on and off 665 Dosimat.
The 665 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.

11 **Earthing socket**

The 665 Dosimat must be grounded effectively, if necessary through the separate earthing socket.

12 **Connection for stirrer**

Normally a Magnetic Stirrer (forms a complete titrating stand). Other stirrers may be connected as well, e.g. a METROHM Rod Stirrer.

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

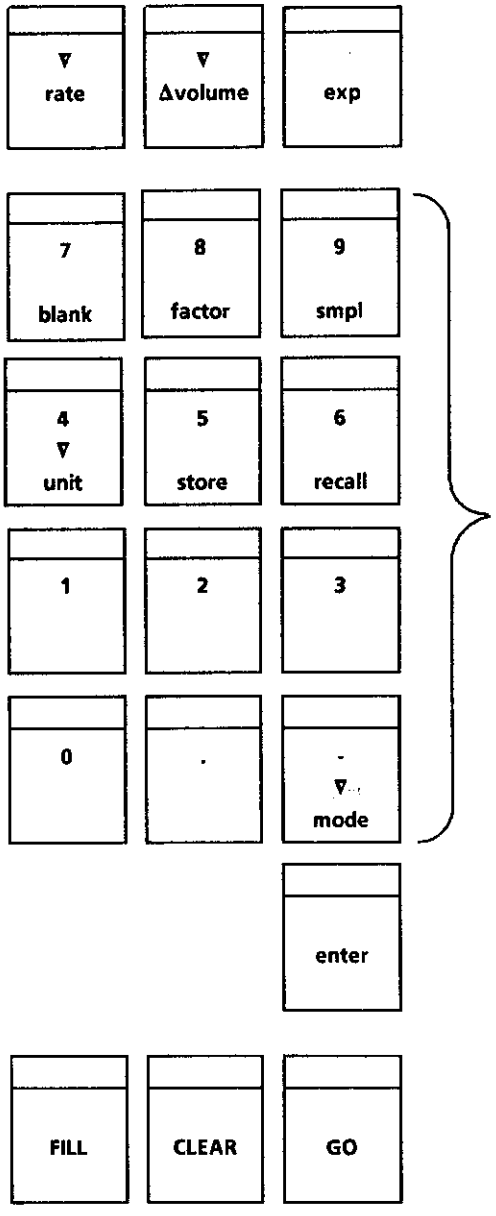
13 **Indication of mains voltage**

14 **Identification plate**

Indication of model, series and serial number.

2. Operation with the keyboard

2.1 Keyboard, data input



Keys for parameters and exponent

Numerical keys;

Calculation parameters
(blank,factor, smpl, unit);

Management of user memory
(store, recall);

Mode selection
(mode).

Main functional keys,
identical with the corresponding keys on the
665 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>.
- The sign ∇ marks keys with 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 therefore depends on the exchange unit used:

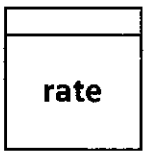
Exchange unit	Resolution	
	Δvolume ml	rate ml/min
1 ml	.001	.001
5 ml	.001	.005
10 ml	.001	.010
20 ml	.002	.020
50 ml	.005	.050

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.

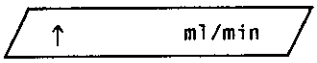
- Key <CLEAR> sets parameters 'rate ↑', 'rate ↓' and 'V-LIM' to "OFF".

2.1.1 Key <rate>

The inquiries of this key are identical for all modes.

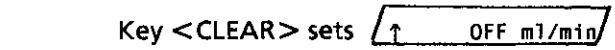


rate: Expelling and filling rate.
This key is accessible live-keyboard (except in mode "DOS"), i.e. rate can be changed during a running function.

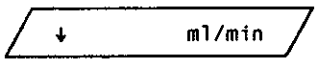


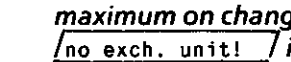
Expelling rate.
The range for digital setting depends on the volume of the exchange unit (EU):

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 

, i.e. the rate can be controlled analogically by means of the potentiometer (4) at the 665 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 

is displayed).

2.2 Modes

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

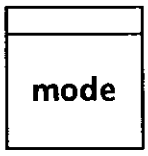
DIS R: DISpensing, Repetitive;
Dosimat is dosing a stored dispensing volume if <GO> is pressed, burette cylinder is refilled and display reset to 0.000 ml.

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

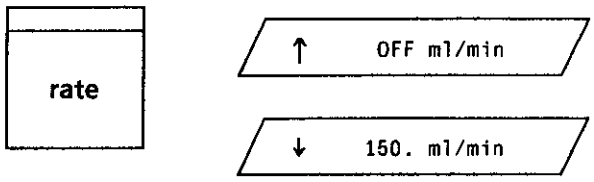
DOS 0.000 ml

Standard parameters:

Δvolume

V-LIM OFF

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

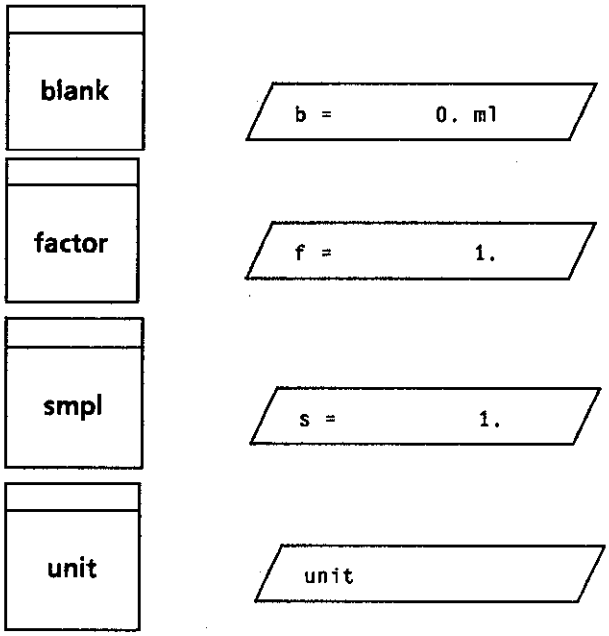


Expelling rate

Input range see page 6

Filling rate

Calculation values:



Blank value
0 ... ± 999.999 ml

Factor
0 ... ± 1E33

Sample size
0 ... ± 1E33, input manually or on-line with balance, see page 68

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

Special settings: see page 23

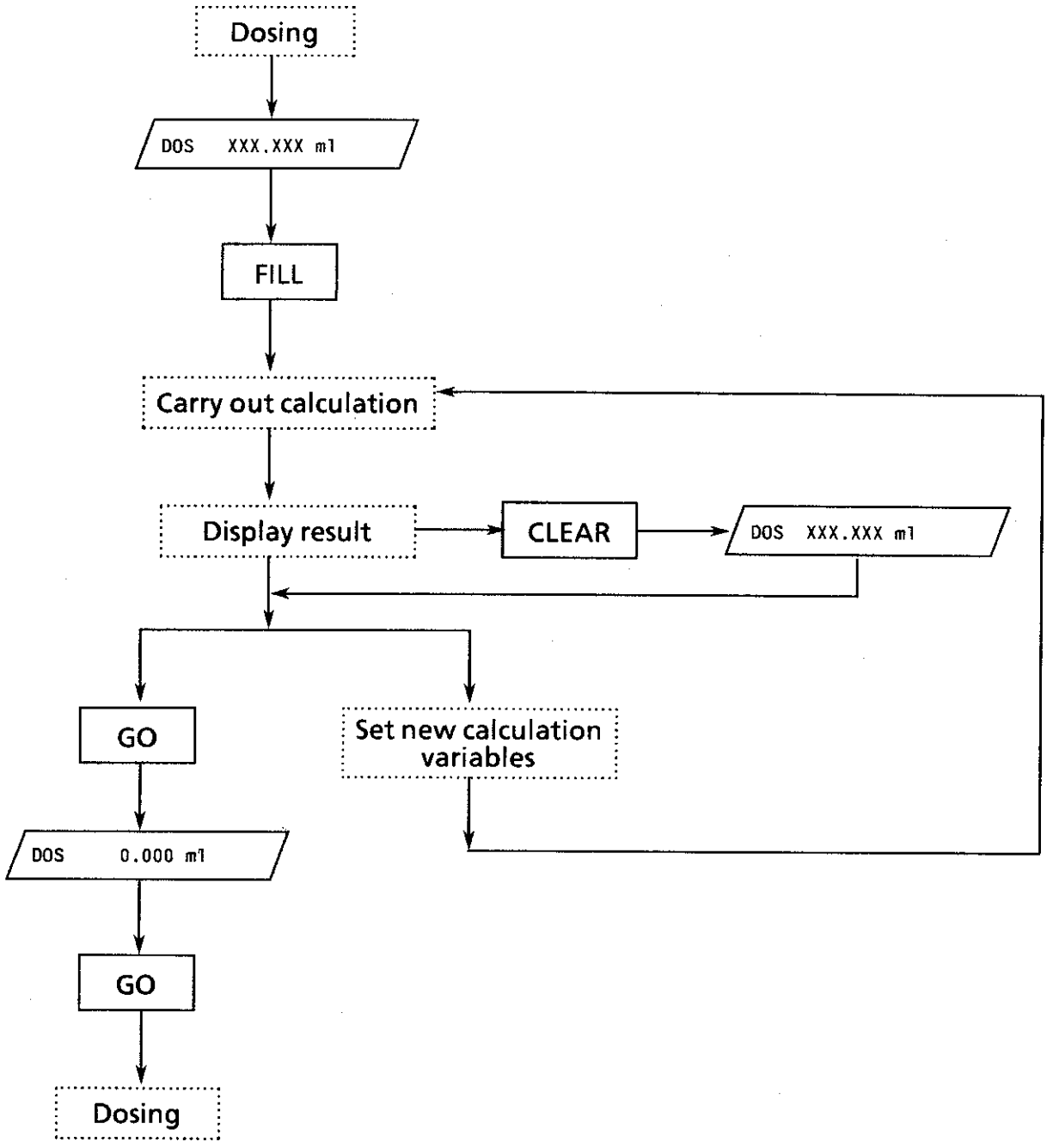
Result calculation:

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:



Printing the result on a printer:

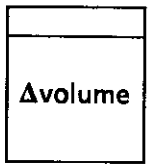
If the Dosimat is set to send RS 232 on (special setting with key <4>, see page 23), filling the Dosimat or re-calculation triggers a print command.
A continuous number (#), the dosed volume and the calculated result are printed.
Set new calculation parameters for the next dosing only if display shows DOS 0.000 ml, i.e. press first <GO> once.
The continuous number is set to zero on switching on the Dosimat and incremented by 1 on every filling in mode DOS.

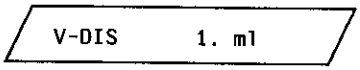
Example: Print-out of serial titrations

```
#01  V =  0.352 ml   R =     7.04 ppm
#02  V =  0.440 ml   R =      8.8 ppm
#03  V =  0.000 ml
#04  V =  0.364 ml   R =     7.28 ppm
#05  V =  0.438 ml   R =     8.76 ppm
#06  V =  0.382 ml   R =     7.64 ppm
#07  V =  0.370 ml   R =    19.61 %
#08  V =  0.372 ml   R =    19.72 %
#09  V =  0.410 ml   R =    21.73 %
#10  V =  0.412 ml   R =    21.84 %
#11  V =  0.398 ml   R =    21.09 %
#12  V =  0.364 ml   R =    19.29 %
#13  V =  0.000 ml
#14  V =  0.306 ml   R =    16.22 %
#15  V =  0.366 ml   R =    5.234 mg/l
#16  V =  0.362 ml   R =    5.177 mg/l
#17  V =  0.378 ml   R =    5.405 mg/l
#18  V =  0.378 ml   R =    5.405 mg/l
#19  V =  0.446 ml   R =    6.378 mg/l
```

2.2.2 Mode DIS R, repetitive dispensing

Standard parameters:

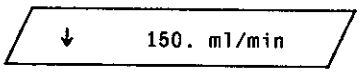




Dispensing volume
.001 ... 999.999 ml

Expelling rate

Input range see page 6

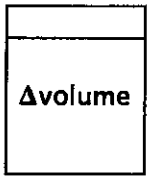


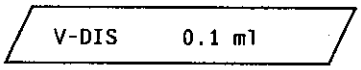
Filling rate

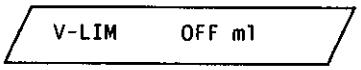
Special settings: see page 23

2.2.3 Mode DIS C, cumulative dispensing

Standard parameters:

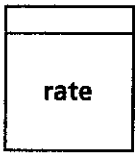


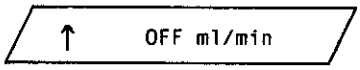


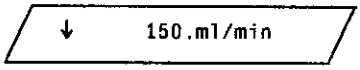


Dispensing volume
.001 ... 999.999 ml

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







Expelling rate

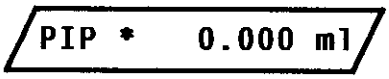
Input range see page 6

Filling rate

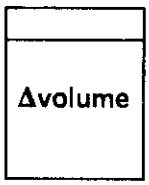
Special settings : see page 23

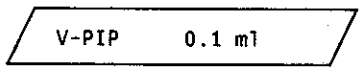
Mode "DIS C" is suitable for continuous dosing with 2 Dosimats (see page 69).

2.2.4 Mode PIP, pipetting



Standard parameters:

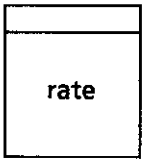


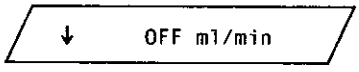


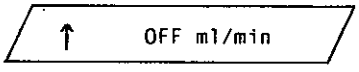
Pipetting volume
Input range depends on the volume of the exchange unit (EU):

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!







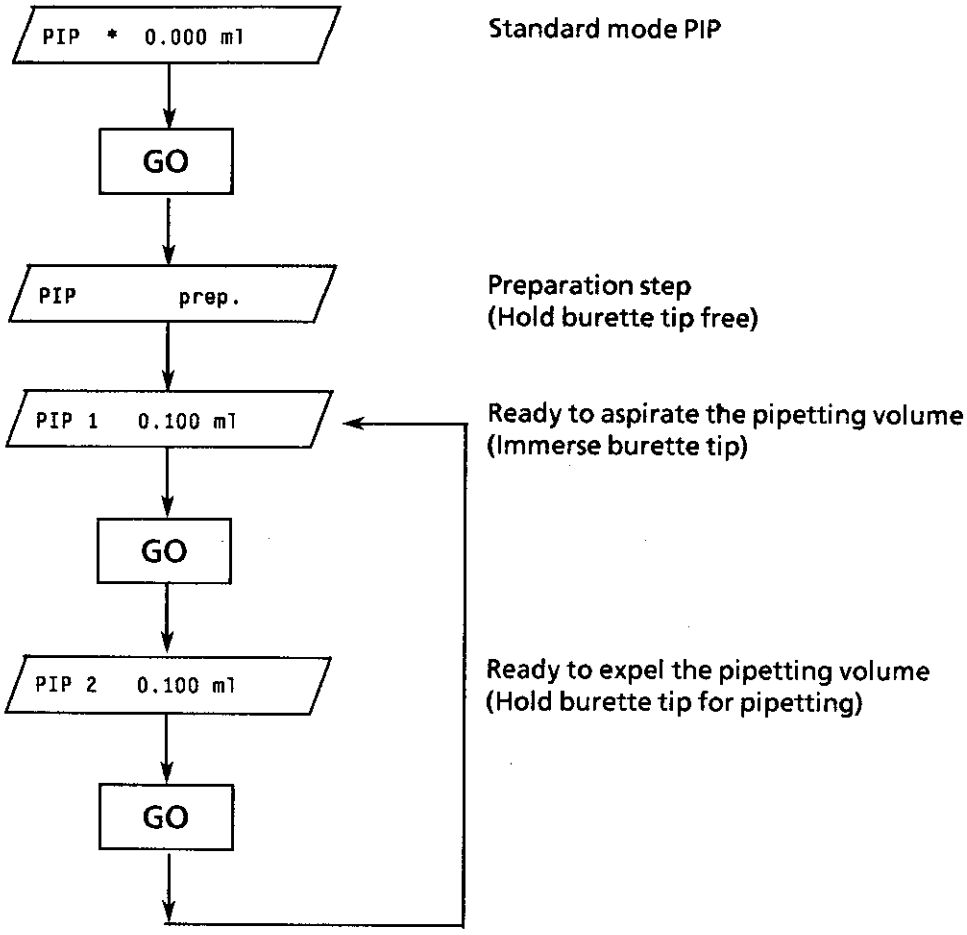
Aspirating rate

Input range see page 6

Expelling rate

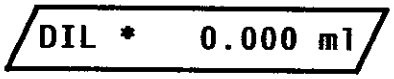
Sign * in the display means that mode "PIP" is not yet ready to use. With a first <GO>, a preparation step is carried out which is marked in display with /PIP prep./. This preparation step includes the formation of an air bubble which serves to separate the transfer solution of the exchange unit from 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":

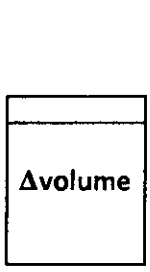


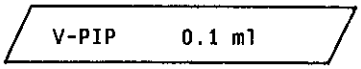
Notes:
- For best pipetting results we recommend exchange units with volumes ≤ 20 ml and 6.5611.000 pipetting equipment, see page 72.The aspirating and expelling rates should not be higher than 20 ml/min.
- Hold tubing tip in an angle of app. 45° to the vessel wall during pipetting. Just the same as 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



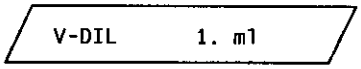
Standard parameters:





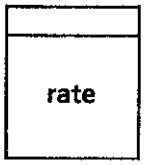
Pipetting volume
Input range depends on the volume of the exchange unit (EU):

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

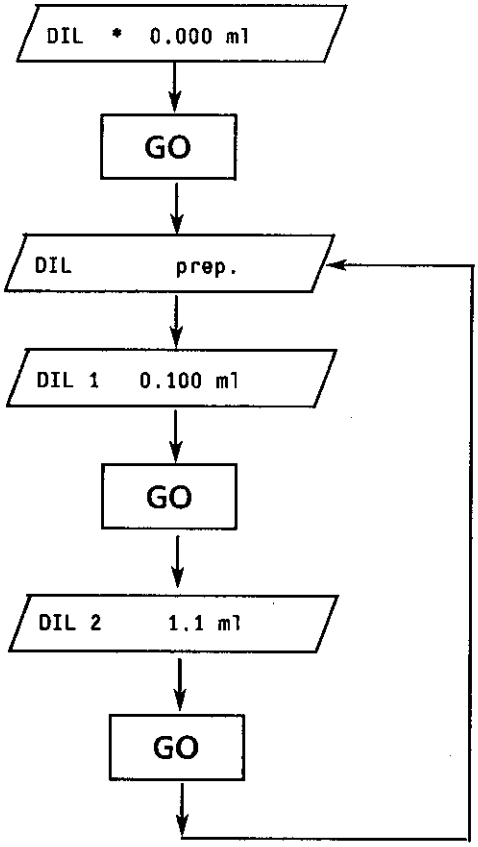
Input range see page 6

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, 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":



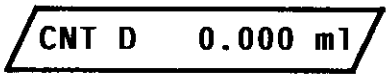
Standard mode DIL

Preparation step
(Hold burette tip free)

Ready to aspirate the pipetting volume
(Immerse burette tip)

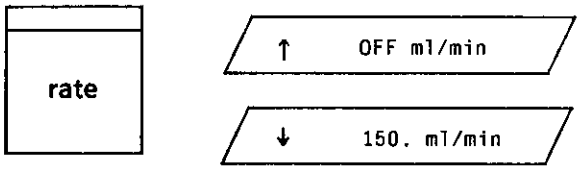
Ready to expel the pipetting and the diluting volumes
(Hold burette tip for pipetting)

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 665 Dosimat dispenses the amount of solvent calculated correspondingly.

Standard parameters:



expelling rate

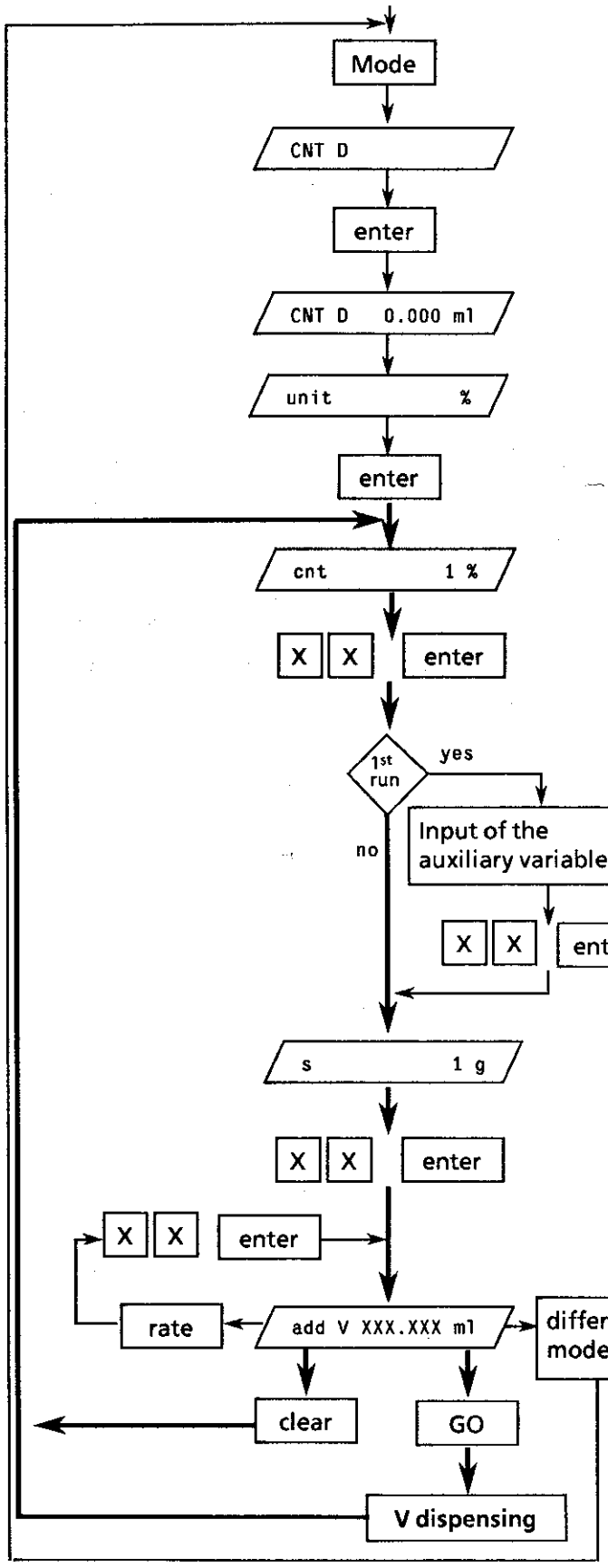
input range, see page 6

filling rate

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

Reference quantity (denominator) / Specified quantity (numerator)	**Concentration**	**Fraction**	**Molality**
	Volume of the solution V / L	**Sum of the components j**	**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
- dens. 1 g/ml
- f= 1.00000

molar mass of the substance
density of the solvent
factor, e.g. for ionic standards, volume contraction, etc.

Input of the weighing, manually or via a balance (balance connection, see page 68)

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	%	$\frac{f \cdot s(10^2-cnt)}{cnt \cdot dens}$
	ppm	$\frac{f \cdot s(10^6-cnt)}{cnt \cdot dens}$
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:

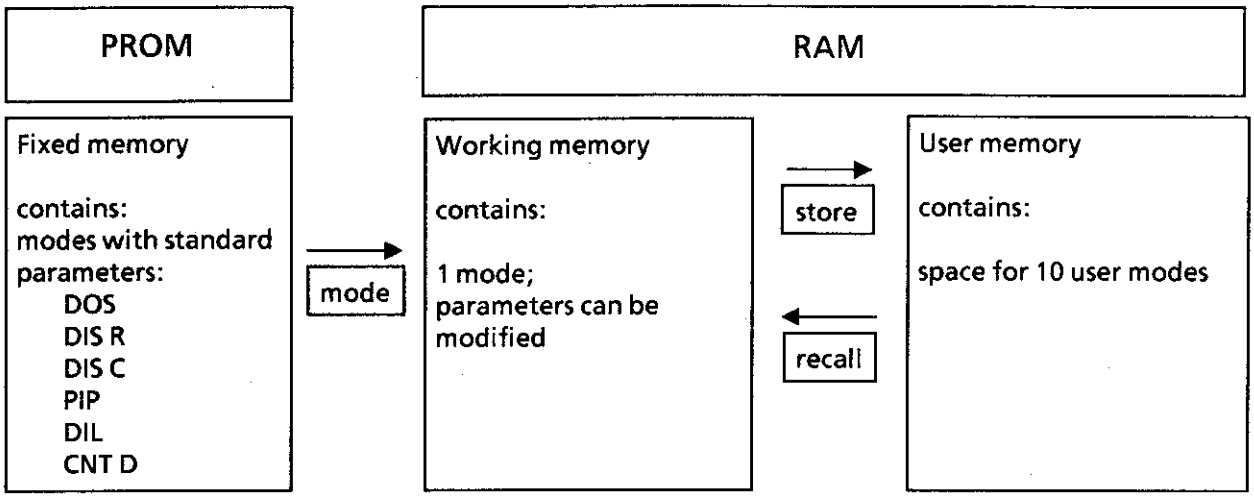
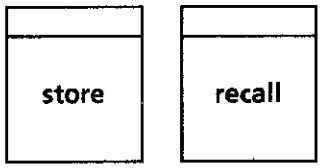


Fig. 2.1



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 665 Dosimat User Memory

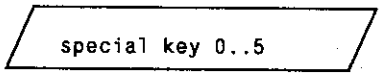
Nr.	Mode	V-DIS/ V-PIP ml	V-LIM/ V-DIL ml	↑ ml/min	↓ ml/min	Calculation
0						
1	DOS		OFF	analog	max.	f=5.85 s=25 g/l
2	DOS		"	"	"	f=0.14 %
3						
4						
5						
6						
7						
8						
9						

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.

Settings can now be done with keys 0...5.

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
< 1 >	baud rate 9.6 K	Setting of baud rate (data transfer rate). (110, 150, 300, 600, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K; press <GO> until the right number is displayed and store with <enter>). Several quantities are set to a fixed value: data bit = 7, parity = even, stop bit = 1.
< 2 >	#V(B)/1000 mV 1	Number of burette volumes per 1000 mV at the analogue output. (1,2,3...10 V(B); press <GO> until the right number is displayed and store with <enter>)
< 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>)
< 4 >	send RS232 off	Data transfer to a printer in mode "DOS". (on = yes; off = no; press <GO> until the right answer is displayed and store with <enter>)
< 5 >	balance Mettler	Choice of balance to be connected. (Mettler, Sartori = Sartorius; press <GO> until the right balance is displayed and store with <enter>, for details see page 68)

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:

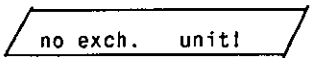
blinking value	The value keyed in is out of the input range (see page 79).

The following list of error messages is alphabetical:

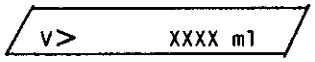
cylinder empty!	The Dosimat is set to auto fill off and one burette volume has been expelled in mode DOS. Exit: <FILL>
error 1	Check sum error in PROM.
error 2	RAM-check: error in on-chip-RAM.
error 3	RAM-check: error in off-chip-RAM.
error 4	RAM-check: error in on- and off-chip-RAM.

} Call METROHM service

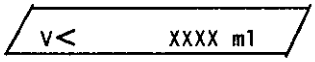
error 5	Check sum error in off-chip-RAM. Exit: RAM has to be re-initialised. Switch Dosimat off. Press <FILL> during switching it on again. Display shows RAM init. Press <GO> . Display shows RAM init. passed. <CLEAR> leads to basic programme with display DOS 0.000 ml (see also page 40) Note: Stored user 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>



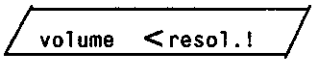
Exchange unit is not (properly) mounted.
Exit: Mount exchange unit properly.
Note: Filling or aspirating rate is set to maximum.



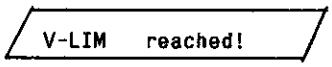
In mode CNT D the volume to be dosed is >999.999 ml.
Exit: <CLEAR> and enter new weight.



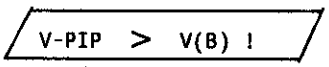
In mode CNT D the volume to be dosed is smaller than the smallest possible increment which can be dosed with the exchange unit mounted.
Exit: <CLEAR> and enter new weight.



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

Der 665 Dosimat ist ein sehr präzises und zuverlässiges Dosiergerät. Dank seines robusten Aufbaus können seine Funktionen kaum durch äussere mechanische oder elektrische Einflüsse beeinträchtigt werden.

Obwohl nicht ganz auszuschliessen ist, dass im Gerät gelegentlich eine Störung auftreten könnte, erscheint die Möglichkeit doch grösser, dass Fehlfunktionen durch Fehlbedienung oder -handhabung oder durch unsachgemässe Verbindungen und den Betrieb mit Fremdgeräten verursacht werden.

In jedem Fall ist es daher ratsam, den Fehler mit der schnell und einfach durchzuführenden Diagnose einzukreisen. Dadurch braucht der Kunde den Metrohmservice erst anzurufen, wenn ein tatsächlicher Fehler im Gerät vorliegt. Zudem kann er dann anhand der Numerierung im Diagnoseprogramm den Servicetechniker viel genauer informieren.

Bei Rückfragen immer Fabrikations- und Programmnummer (siehe Sondereinstellungen) angeben, und evtl. Fehleranzeige angeben.

(Achtung: Falls die Tastatur 6.2124.000 nicht zur Verfügung steht, können nur die Punkte 10 und 11 dieser Anleitung durchgeführt werden.)

Vorgehen

- Die Diagnoseschritte sind der Reihe nach auszuführen und mit den Reaktionen des Dosimaten (eingerückt) zu vergleichen. Im "Ja"-Fall ist mit der nächsten Anweisung weiterzufahren.

- Zeigt das Gerät nicht die erwartete Reaktion ("Nein"-Fall), so ist der entsprechende Diagnoseschritt zu wiederholen, um Bedienungsfehler auszuschliessen. Mehrmalige Falschreaktionen deuten jedoch mit grosser Wahrscheinlichkeit auf eine Störung hin.

- Gebrochen unterstrichene Zeichen in der Anzeige bedeuten, dass diese blinkend erscheinen.

- Die mit einem Dreieck (▷) bezeichneten Diagnoseschritte erlauben bei Wiederholungen einen Wiedereinstieg in den Testablauf unter folgender Voraussetzung:

  Diagn. key Ø...7

  Wenn nicht: Taste "CLEAR" drücken (evtl. mehrmals)
  Nötigenfalls das Netz AUS und nach einigen Sekunden wieder einschalten. Gleichzeitig Taste 9 drücken, bis die Anzeige 'diagn. key 0...7' erscheint.

- Nach dem Drücken der Taste "CLEAR" während der Anzeige 'diagn. key 0...7' springt das Gerät ins Geräteprogramm zurück. Für den Wiedereinstieg in die Diagnose siehe vorgängigen Punkt.

- Fehleranzeige: Ein Fehler wird in der Anzeige folgendermassen dargestellt:

  Error — Exx:yyyyyyyyyyyy
  Fehler-Nr. — Text

  Beispiel: E50: f out limit

The 665 Dosimat is an extremly precise feeding instrument of high performance and reliability. Its solide 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 or improper operation of peripheral units.

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 program number (see special keys) of the instrument. If displayed, also state the fault indication.

(Note: If the key board 6.2124.000 is not available, only items 10 and 11 of these instructions can be carried out.)

Procedure

- Carry out the test steps in order and check whether the Dosimat responds as described. If this is the case, carry out the next step.

- If the instrument does not respond as expected repeat the corresponding diagnosis step in order to exclude possible handling error. If the instrument's response differs from what it should be, the instrument is likely to be defective.

- 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:

  Diagn. key Ø...7

  If the above message is not in the display, press "CLEAR" key (perhaps several 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:

  Error — Exx:yyyyyyyyyyyy
  fault no. — text

  Example: E50: f out limit

- Durch einen Fehler in der Steuerelektronik besteht die Möglichkeit, dass der Büretten-antrieb am oberen oder unteren Ende des Zylinders verklemmt. Bei einer Verklemmung am oberen Ende und bei einem Stillstand des Antriebs generell kann aber die Wechseleinheit nicht mehr entfernt werden. In diesem Fall ist wie folgt vorzugehen:

- 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:

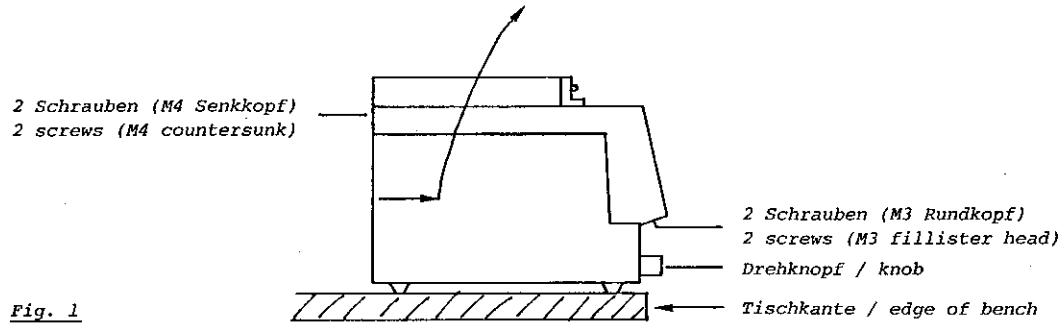


Fig. 1

- Gerät vom Netz trennen!
- Drehknopf entfernen
- Gerät so über Tischkante stellen, dass die M3-Schrauben entfernt werden können (Fig. 1)
- M4-Schrauben entfernen
- Geräteoberteil samt Wechseleinheit durch die mit dem Pfeil angegebene Bewegung abheben

Achtung: Die elektronischen Schaltungen sind jetzt zugänglich!! Diese auf keinen Fall berühren. !

- Spindel durch drehen am grossen Zahnrad vom mechanischen Anschlag entfernen (Bei Motorstillstand Spindel von Hand in 0-Position bringen).

- 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).

Regenerieren der Anzeige

Eine einseitige Beanspruchung der Anzeige kann die Ursache für unterschiedliche Helligkeit der Leuchtpunkte sein. Die Diagnose ermöglicht deshalb ein Regenerieren der Anzeige. Dazu wird die "Diagnose Anzeige" (s. Punkt 4) benutzt und deren Gruppe 1 solange laufen gelassen, bis in der Anzeige 16x das Punktemuster steht: stop durch < 5 >. Dieses Muster wird solange eingeschaltet gehalten, bis sich ein befriedigendes Resultat ergibt.

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.

Benötigte Geräte:

- Wechseleinheiten möglichst unterschiedlicher Zylindervolumina (oder Dummy-Wechseleinheit 3.496.0070)
- Stoppuhr oder Uhr mit Sekundenzeiger
- Drucktastenkabel 6.2107.000 (EA 858) oder normales Laborkabel mit 4 mm Bananensteckern
- Tastatur 6.2124.000

Nur erforderlich, wenn auch externe Funktionen überprüft werden sollen:

- Digital- oder Analogvoltmeter (evtl. angeschl. geeichten Schreiber verwenden)
- Teststecker 3.496.8360

1. Tastatur anschliessen

1.1 Externanschlüsse (und evtl. angeschlossenes Rührwerk) entfernen
Wechseleinheit entfernen

1.2 Netz EIN und sofort die Taste 9 drücken (gedrückt halten, bis Einschalt-Testmuster verschwindet)

diagn. key 0...7

2. Diagnose Zylindercode

2.1 < 0 > drücken

cylinder code

2.2 < GO > drücken

no exch. unit!

2.3 Wechseleinheit (oder Dummy) aufsetzen

code: xx ml

xx: überprüfen, ob ml-Code der verwendeten Wechseleinheit angezeigt wird

Der Vollständigkeit halber können verschiedene Wechseleinheiten aufgesetzt und der Code abgelesen werden.

Fehleranzeige:
Ist eine Wechseleinheit falsch codiert oder liegt in den Codeschaltern ein Defekt vor, so erscheint die Anzeige: E 90: ..no code!

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 6.2124.000

Additional requirements to check external functions:

- Digital or analogue voltmeter (perhaps a calibrated recorder)
- Test plug 3.496.8360

1. Connect key board

1.1 Disconnect external connections and stirrer
Remove exchange unit

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

diagn. key 0...7

2. Diagnosis of cylinder code

2.1 Press < 0 >

cylinder code

2.2 Press < GO >

no exch. unit!

2.3 Insert (dummy) exchange unit

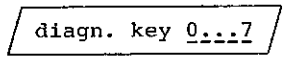
code: xx ml

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

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

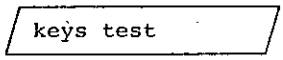
Fault indication:
If an exchange unit is coded incorrectly or if the code switches are inoperative, the display shows: E 90: ..no code!

2.4 < CLEAR > drücken

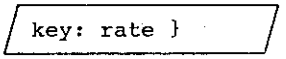


3. Diagnose Tastatur

3.1 < 1 > drücken

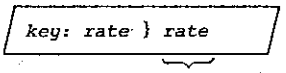


3.2 < GO > (oder < enter >) drücken



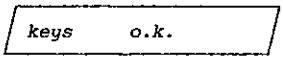
*

In der Anzeige steht nun die Aufforderung, eine Taste (im Beispiel 'rate') der Tastatur 6.2124.000 zu drücken. Wird diese gedrückt, so erscheint kurz der Name der betreffenden Taste (im Beispiel 'rate') auf der rechten Seite der Anzeige:



während 50 ms

Ist dieser Test positiv verlaufen, so erscheint anschliessend der Name der nächsten zu drückenden Taste, usw.
Nach der letzten Taste (GO) erscheint:



Fehleranzeige:

a) Erscheint der Name der gedrückten Taste nicht (während 50 ms) rechts in der Anzeige, so ist die Taste defekt (oder der entsprechende Signalpfad unterbrochen).

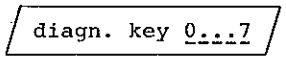
b) Erscheint die Anzeige E 10: und rechts der Name einer anderen Taste, so liegt ein Fehler in der Tastaturmatrix vor, oder es wurde die falsche Taste gedrückt.

Eine allfällige Fehleranzeige kann durch drücken der Taste 'CLEAR' wieder aufgehoben werden. Mit der Anzeige 'breaking off' werden Sie gefragt, ob Sie den Test abbrechen wollen, was Sie mit 'CLEAR' tun können. Man kann aber den Test auch mit < GO > wieder fortsetzen, bis die Anzeige "keys test end" erscheint.

---

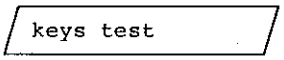
* Bei gewissen Geräten "=" statt "}", siehe * bei 4.2

2.4 Press < CLEAR >

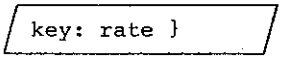


3. Diagnosis of key board

3.1 Press < 1 >

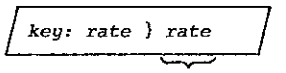


3.2 Press < GO > (or < enter >)



*

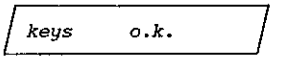
The display requests to press a key on the keyboard 6.2124.000 ("rate" in this example). After pressing this key the respective key briefly appears on the right-hand side of the display (example "rate"):



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 "keys test end".

---

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

3.3 < CLEAR > drücken

diagn. key 0...7

4. Diagnose Anzeige

4.1 < 2 > drücken

display test

4.2 < GO > drücken

Es werden Zeichen zur optischen Kontrolle der Anzeige generiert, in 5 Gruppen:

Gruppe:

1) Alle Punkte der 7x5 Punktmatrix leuchten (entsprechend 7F in der Tabelle)

2) ganze Anzeige wird gelöscht (ca. 1 s) (entsprechend 00 und 20 in der Tabelle)

*3) * Schachbrettmuster erscheint 16 mal in der Anzeige. Muster wechselt alle 300 ms mit seinem inversen Bild (entsprechend 01 und 02 in der Tabelle)*

4) Alphabet in Grossbuchstaben wird angezeigt, wobei 16x der gleiche Buchstabe in der Anzeige steht; Wechsel nach gleicher Zeit wie oben

5) Zeichensatz wird endlos in Laufschrift angezeigt (ab 20...7F, 00...1F)*

Anhalten des Testablaufs: durch < 5 >
Neustart " " : erneut < 5 >
Angefangenen Zyklus (Gruppen 1, 2, 4, 5) abbrechen:
(1x) < 5 >, < CLEAR > (es erscheint die nächste Gruppe)

(Gruppe 3 kann nur gestartet und gestoppt werden)
Gruppe 5 wird, falls nicht durch < 5 > und < CLEAR > abgebrochen, endlos angezeigt.

* Es ist möglich, dass bei gewissen Serien Anzeigetreiber mit einem verminderten Zeichensatz eingesetzt werden, bei denen das Schachbrettmuster nicht erscheint, sondern an dessen Stelle nur abwechslungsweise " ! . In der Gruppe 5 wird ausserdem der Zeichensatz 00...1F nicht erscheinen.

3.3 Press < CLEAR >

diagn. key 0...7

4. Diagnosis of display

4.1 Press < 2 >

display test

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 to 7F, then 00 to 1F)*

To stop the running test: press < 5 >
Restart the test: press < 5 > again
Breaking off a cycle in process (groups 1, 2, 4, 5):
(1x) < 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 >.

* 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.

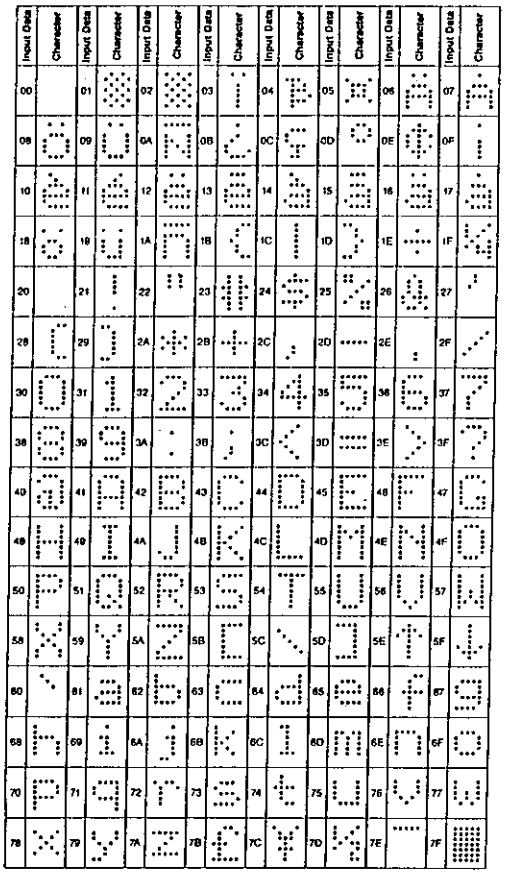


Fig. 2 Charaktertabelle

Fig. 2 Table of characters

Nach Abbruch der Gruppe 5 erscheint:

DP, keys test

↑— während 1,5 s

Anschliessend erscheint:

key: FILL }

↑— Name der Taste auf dem Dosimaten

Prozedere wie unter 3.2, jedoch Tasten auf dem Dosimaten betätigen

Nach erfolgter Prüfung erscheint:

display o.k.

4.3 < CLEAR >

diagn. key 0...7

5. Diagnose Analosausgang

(nur sofern eingebaut, standardmässig bei Varianten 2.665.0020
2.665.0040,
falls nicht eingebaut, weiter bei 6.)

After breaking off group 5 there appears:

DP, keys test

↑— for 1.5 s

Afterwards:

key: FILL }

↑— name of key on Dosimat

Proceed as under 3.2, however actuate keys on Dosimat

When the test is terminated:

display o.k.

4.3 < CLEAR >

diagn. key 0...7

5. Diagnosis of analogues output

(if fitted only; fitted as a standard with versions 2.665.0020
2.665.0040,
if not fitted go on with item 6)

5.1 Spannungsmessgerät (Voltmeter, DVM, Schreiber) an Analogausgang anschliessen:

Stecker A/21 (0÷+1 V) } s. auch Gebrauchs-
Stecker A/11 (ground) } anweisung, S. 51

5.2 < 3 >

analog output

5.3 < GO >

V-out = 0.000 V

Spannungsmessgerät zeigt 0 V (Toleranz ±6 mV). Toleranz des Messgerätes berücksichtigen!

5.4 < GO >

V-out = 1.000 V

Spannungsmessgerät zeigt Δ+1.000 V (Toleranz: ±6 mV + Tol. von 5.3)

5.5 < GO >

V-ramp 1...2

In dieser Testposition produziert der Dosimat am Analogausgang eine Spannungsrampe (Dreieckspannung) U = 0V...1V...0V. Es können 2 verschiedene Anstiegs- bzw. Abfallzeiten gewählt werden:

mit Taste 1 und GO:
Anstiegs- bzw. Abfallzeit = 48 ms
*fortgesetzte Rampe für Ueberprüfungen mit dem Oszilloskop * → Service (Austritt mit < CLEAR >)*

mit Taste 2 und GO:
Anstiegs- bzw. Abfallzeit = 40 s
Rampe (1x), für Ueberprüfungen mit einem Schreiber (Austritt erfolgt automatisch).

5.6 < 2 >

V-ramp = 40s ↑/↓

5.7 < GO >

V-ramp = 40s ↑/↓

Es wird eine Rampe aufgezeichnet (Dauer: 80 s)

* Bei Verwendung eines Kabels am Analogausgang kann der KO HF-Schwingungen registrieren, die jedoch keine Störung verursachen. Eine entsprechende Aenderung ist in Vorbereitung.

5.1 Connect voltmeter, DVM or recorder to the analogue output:

plug A pin 21 (0 to +1 V) } see also instr.
plug A pin 11 (ground) } for use, page 51

5.2 < 3 >

analog output

5.3 < GO >

V-out = 0.000 V

Measuring instrument reads 0 V (tolerance ±6 mV). Take also into account the tolerance of the measuring instrument!

5.4 < GO >

V-out = 1.000 V

Measuring instrument reads Δ+1.000 V (tolerance: ±6 mV + tol. of point 5.3)

5.5 < GO >

V-ramp 1...2

In this test sequence the Dosimat produces at the analogue output a voltage ramp (triangle voltage) U = 0V...1V...0V. Two different rising or falling times can be selected:

with key 1 and GO:
rising or falling time = 48 ms each
*continued ramp for examination with the oscilloscope * → service (leave with < CLEAR >)*

with key 2 and GO:
rising or falling time = 40 s each
ramp (1x), for examinations with a recorder (leaving happens automatically)

5.6 < 2 >

V-ramp = 40s ↑/↓

5.7 < GO >

V-ramp = 40s ↑/↓

A ramp is produced (duration 80 s)

* When connecting a cable to the analogue output, RF oscillations may be registered by the CRO, however, they do not cause any trouble. A respective modification is in preparation.

13.6.86

5.8 Die Aufzeichnung überprüfen:

- Linearität der Aufzeichnung
- (evtl.) Länge des Papiervorschubes, entsprechend 40 s und gewählter Einstellungen

Nach Beendigung erscheint die Anzeige:

V-ramp 1...2

5.9 < CLEAR >

diagn. key 0...7

6. Diagnose Digitaltimer

(Der Digitaltimer ist der Teil der elektronischen Schaltung im Dosimaten, der für die digitale Spindelgeschwindigkeit verantwortlich ist.)

6.1 < 4 >

timer dig. test

6.2 < GO >

timer dig.

Es wird die Frequenz des Digitaltimers während 1,5 s gemessen. Ist Testverlauf positiv, so erscheint in der Anzeige o.k., andernfalls E 50.

6.3 < CLEAR >

diagn. key 0...7

7. Diagnose Analogtimer

(Der Analogtimer ist der Teil der elektronischen Schaltung im Dosimaten, der für die analoge Spindelgeschwindigkeit (einstellbar am Knopf 'dV/dt') verantwortlich ist.)

7.1 Knopf 'dV/dt' an den Rechtsanschlag drehen

7.2 < 5 >

timer ana. test

5.8 Examine the recorded ramp:

- linearity of the ramp
- perhaps length of advanced paper, corresponding to 40 s and settings selected

When terminated display:

V-ramp 1...2

5.9 < CLEAR >

diagn. key 0...7

6. 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.)

6.1 < 4 >

timer dig. test

6.2 < GO >

timer dig.

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.

6.3 < CLEAR >

diagn. key 0...7

7. 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").)

7.1 Turn knob "dV/dt" fully to the right

7.2 < 5 >

timer ana. test

7.3 < GO >

timer ana.

Es wird die Frequenz des Analogtimers während 1,5 s gemessen. Ist der Testverlauf positiv, so erscheint in der Anzeige o.k., andernfalls E 51.

7.4 < CLEAR >

diagn. key 0...7

8. Diagnose Extern Ein- und Ausgänge

Dieser Test ist nur sinnvoll, wenn der 665 Dosimat über den Stecker am Anschluss A mit andern Geräten zusammengeschaltet benützt wird. Zudem wird für diesen Test ein Teststecker 3.496.8360 benötigt, der normalerweise im Reparaturservice eingesetzt wird. Dieser Stecker kann aber mit der obigen Nummer auch von Kunden erworben werden.

Der Vollständigkeit halber sei hier das Vorgehen angegeben.

(Falls Diagnose der Extern-Ein- und Ausgänge nicht erwünscht, weiter bei Punkt 9.)

Verbindungen im Teststecker 3.496.8360:

OUT			IN		
Ready	(#Rdy#)	---------->	536	(#536#)	
Limit Vol.	(#LV0#)	---------->	G02	(#G02#)	
Job End	(#JEn#)	---------->	FILL	(#FILL#)	
Reserve	(#Res#)	---------->	Res.	(#RES#)	G01 & G02 = GO
Imp 10'000	(#Ip1#)	---------->	G01	(#G01#)	
RTS	(#RTS#)	---------->	CTS	(#CTS#)	
DTR	(#DTR#)	---------->	DSR	(#DSR#)	
TxD	(#TXD#)	---------->	RLSD	(#RLSD#)	u. RxD (#RXD#)
				(beide : #RxRL#)	

8.1 Stecker 3.496.8360 an Platz A einstecken (Gerät nicht ausschalten, auf Richtung des Steckers achten!), roten Bananenstecker in rote Buchse 'D'.

8.2 < 6 >

extern in/output

8.3 < GO >

Die Externausgänge sind über den Stecker 3.496.8360 mit den entsprechenden Eingängen verbunden. Das Diagnoseprogramm setzt jeden Ausgang 5x auf logisch 1 und 0 und fragt gleichzeitig über den entsprechenden Eingang den Zustand ab.

Ist der Testverlauf positiv, so erscheint in der Anzeige o.k., andernfalls erscheint eine Errormeldung E.. zusammen mit der Angabe der betreffenden Leitung (gemäss obenstehender Tabelle).

7.3 < GO >

timer ana.

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.

7.4 < CLEAR >

diagn. key 0...7

8. Diagnosis of external inputs, outputs

This test is necessary only if the 665 Dosimat is interconnected with other instruments via terminal A. Moreover, this test requires the test plug 3.496.8360 which is a facility for the repair service. However, it can also be ordered by customers with the above order number.

For the sake of completeness the respective procedure is stated below.

(If diagnosis of external inputs/outputs not needed, go on with item 9.)

Connections in test plug 3.496.8360:

OUT			IN		
Ready	(#Rdy#)	---------->	536	(#536#)	
Limit Vol.	(#LV0#)	---------->	G02	(#G02#)	
Job End	(#JEn#)	---------->	FILL	(#FILL#)	
Reserve	(#Res#)	---------->	Res.	(#RES#)	G01 & G02 = GO
Imp 10'000	(#Ip1#)	---------->	G01	(#G01#)	
RTS	(#RTS#)	---------->	CTS	(#CTS#)	
DTR	(#DTR#)	---------->	DSR	(#DSR#)	
TxD	(#TXD#)	---------->	RLSD	(#RLSD#)	u. RxD (#RXD#)
				(beide : #RxRL#)	

8.1 Insert plug 3.496.8360 to location A. (Do not switch off the unit, take care of the direction of the plug!) Red banana plug to red socket 'D'.

8.2 < 6 >

extern in/output

8.3 < GO >

The external outputs are connected to the respective inputs via plug 3.496.8360. The diagnosis program sets each output 5 times to log 1 and log 0 and simultaneously scans the respective inputs.

If the test is positive, the display shows o.k. otherwise it reads an error message E.. together with the respective connection (see table above).

Fehlermeldungen:

E 55: Ein Ausgang ist auf 1 gesetzt; der betreffende Eingang weist aber den Pegel 0 auf
z. B. E 55: Rdy = 1/536 = 0

E 56: Ein Ausgang ist auf 1 gesetzt; ein nicht betroffener Eingang weist aber den Pegel 1 auf
z. B. E 56: Rdy = 1/GO 2 = 1

E 57: Alle Ausgänge sind auf 0 gesetzt, aber einer der Eingänge weist Pegel 1 auf
z. B. E 57: 00 /RxRL = 1
RxRL: beide Eingänge RxD und RLSD haben den Logikpegel 1

Im Fehlerfalle mit < GO > weiterfahren bis Anzeige "ext. in/out end"

8.4 < CLEAR >

diagn. key 0...7

Stecker 3.496.8360 wieder entfernen

9. Diagnose Spindelantrieb und Hahnumschaltung

9.1 Drucktastenkabel 6.2107.000 (EA 858) anschliessen (sofern vorhanden)

9.2 Netz aus
5 s warten

9.3 Netz EIN und gleichzeitig < 0 > drücken (gedrückt halten, bis Punktemuster verschwindet)

special key 0..5

9.4 < 3 >

auto fill

ablesen, ob 'on' oder 'off' (Einstellung aufschreiben oder sich merken!)

9.5 *nur ausführen, falls auto fill 'on':*
(sonst weiter mit 9.6!)

< GO >

auto fill off

Fault indication:

E 55: An output is set to 1, the respective input, however, has log 0
e.g. E 55: Rdy = 1/536 = 0

E 56: An output is set to 1, a wrong input, however, has log 1

e.g. E 56: Rdy = 1/GO 2 = 1

E 57: All outputs are set to 0, but one of the inputs has log 1
e.g. E 57: 00 /RxRL = 1
RxRL: both inputs RxD and RLSD have log 1

In case of error continue with < GO > until display reads "ext. in/out end"

8.4 < CLEAR >

diagn. key 0...7

Withdraw plug 3.496.8360 again

9. Diagnosis of spindle drive and cock changeover

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

9.2 Power off
wait for 5 s

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

special key 0..5

9.4 < 3 >

auto fill

check whether display reads "on" or "off" (make note!)

9.5 *Carry out only if auto fill "on":*
(otherwise go on with item 9.6!)

< GO >

auto fill off

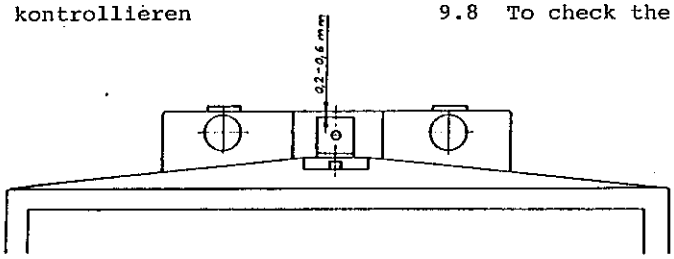
9.6 < enter >, < CLEAR >

In der Anzeige erscheint das Punktemuster und anschliessend der vor Beginn der Diagnose zuletzt benützte Mode

Dosimat füllt

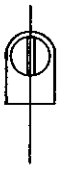
9.7 Wechseleinheit entfernen

9.8 Spindelnullpunkt kontrollieren



Die Spindel muss 0,2 - 0,6 mm unter der Kante der Aufnahmeplatte liegen

9.9 Der Steg der Hahnkupplung muss genau parallel zu den Seitenkanten des Dosimaten liegen



9.10 Wechseleinheit wieder aufsetzen

Dosimat füllt

Es erscheint wieder der vor der Durchführung der Diagnose zuletzt benützte Mode in der Anzeige.

9.11 < mode > mehrmals drücken bis

DOS

erscheint.

9.12 < enter >

DOS 0.000 ml

9.13 < rate >

↑ OFF ml/min

9.14 < rate >

↓ xx ml/min

xx: (je nach WE-Code)

9.6 < enter >, < CLEAR >

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

Dosimat fills

9.7 Remove exchange unit

9.8 To check the spindle zero

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

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

9.10 Insert exchange unit again

Dosimat fills

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

9.11 Actuate < mode > several times until the display reads

DOS

9.12 < enter >

DOS 0.000 ml

9.13 < rate >

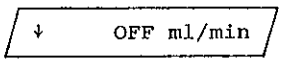
↑ OFF ml/min

9.14 < rate >

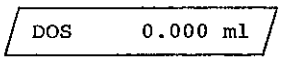
↓ xx ml/min

xx: (depending on exchange unit code)

9.15 < CLEAR >



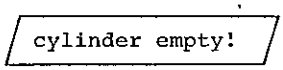
9.16 < enter >



9.17 (Knopf 'dV/dt' an den Rechtsanschlag)

9.18 Dosiertaste 6.2107.000 (falls nicht vorhanden, < GO >) drücken, bis Kolbenstange am oberen Ende ankommt und gleichzeitig die Zeit von Start bis Ende messen.

9.19



Spindel bleibt auf Maximalposition stehen

Die Durchlaufzeit der Spindel beträgt 20 s

9.20 Spindelhöhe messen (kann nur durchgeführt werden, wenn die Dummywechseleinheit 3.496. 0070 aufgesetzt ist oder der Verriegelungsschalter (im rechten Loch) nach Entfernen der Wechseleinheit vorsichtig mit einem Schraubenzieher betätigt wird).

Von Punkt 9.8 ausgehend legt die Spindel einen Weg von 80 mm zurück.

Statt der Spindelhöhe kann auch das ausgestossene Volumen nachgemessen werden (entsprechend max. Vol. der verwendeten Wechseleinheit).

9.21 < FILL > betätigen und gleichzeitig die Zeit messen, bis Dosimat wieder in Position 'ready' ist.

Zeiten für Füllen: pro Hahnzyklus je 1 s
für Füllen 20 s

Allgemein gilt:

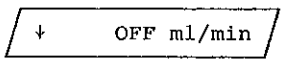
Spindle und Hahn müssen sich mit gleichmässiger Geschwindigkeit bewegen (Geräusch!)

Auf Stellung Füllen muss die Hahnkupplung den Hebel der Wechseleinheit einwandfrei an den linken Anschlag stellen (fast ohne Spiel und ohne zu klemmen).

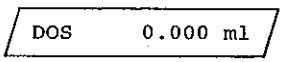
9.22 Potentiometer 'dV/dt' an Linksanschlag stellen

9.23 < mode > : DIS R wählen

9.15 < CLEAR >



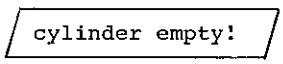
9.16 < enter >



9.17 (Knob "dV/dt" fully to the right)

9.18 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.

9.19



Spindle remains at top position

The running time of the spindle is 20 s

9.20 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 9.8.

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

9.21 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).

9.22 Turn potentiometer "dV/dt" fully to the left

9.23 < mode > : select DIS R

9.24 < enter >

DIS R 0.000 ml

9.25 < Δ volume >

V-DIS 1.ml

9.26 Je nach aufgesetzter Wechseleinheit, das untenstehende Volumen eingeben

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

9.27 < enter >

9.28 < GO > (kurz drücken) und mit der Stoppuhr die Zeit messen, bis Hahn dreht. Die Zeit soll ca. 19 s betragen (±5 s)

Wenn unter 9.4 auto fill = on eingestellt war, diesen Parameter gemäss Punkt 9.2 - 9.6 wieder einstellen.

Testende

Mit den obigen Diagnoseschritten sind weitaus die meisten Funktionen des 665 Dosimaten geprüft. Besteht jedoch der Verdacht, dass im Dosimaten gespeicherte Daten verlorengehen, obwohl der RAM-Test bei 'Netz ein' (s. auch Seite 18) positiv verlaufen ist, so kann zusätzlich der Endlos-RAM-Test (s. Punkt 10) durchgeführt werden.

10. Endlos-RAM-Test (zerstörungsfrei)

(kann auch ohne Tastatur 6.2124.000 durchgeführt werden)

10.1 Netz aus (5 s warten)

10.2 Netz ein und gleichzeitig < CLEAR > drükken, bis in der Anzeige 'RAM test' erscheint

10.3 < GO >

RAM test !_

9.24 < enter >

DIS R 0.000 ml

9.25 < Δ volume >

V-DIS 1.ml

9.26 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

9.27 < enter >

9.28 < 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 9.4 the reading was "auto fill = on" set this parameter again according to items 9.2 to 9.6.

End of test

Most of the functions of the 665 Dosimat are examined with the above diagnosis steps. However, in case of suspicion that date stored in the Dosimat might get lost although the RAM test at power on (see also page 18) was positive, the endless RAM test can be carried out in addition (see item 10).

10. Endless-RAM-test (non-destructive)

(can be performed also without key board 6.2124.000)

10.1 Power off (wait for 5 s)

10.2 Power on and simultaneously press < CLEAR > until the display shows "RAM test"

10.3 < GO >

RAM test !_

Der Prozessor prüft nun zerstörungsfrei das ON-Chip-RAM und das OFF-Chip-RAM im 665 Dosimaten. Das Ausrufezeichen zeigt an, dass der Test positiv verlaufen ist. Der Test kann beliebig lange fortgesetzt werden. Verläuft der Test negativ, so ergeben sich folgende Fehlermeldungen:

"E02: on-chip RAM": Fehler im ON-Chip-Memory
"E03:off-chip RAM": Fehler im OFF-Chip-Memory
"E04: both RAM s ": Fehler auf beiden Memorys

10.4 Der Test wird mit < CLEAR > abgebrochen (Taste nur solange drücken, bis das Punktemuster erscheint!)

Dosimat füllt
Anzeige zeigt vorherigen Mode an.

Achtung:
Den Endlos-RAM-Test nie durch 'Netz aus', sondern durch < CLEAR > verlassen!

11. RAM-Initialisierung

Ist beim RAM-Test (Punkt 10) fälschlicherweise das Netz ausgeschaltet worden oder werden bei Reparaturarbeiten Eingriffe in die Schaltung gemacht, so kann es passieren, dass die Initialisierungsdaten im RAM verloren gehen. Dies wird bei 'Netz ein' in der Anzeige mit 'error 5' angezeigt. Jede weitere Eingabe über die Tastatur ist dann unmöglich, bis das RAM wieder initialisiert ist.

Vorgehen:

11.1 Netz aus (5 s warten)

(alle Externverbindungen entfernt!)

11.2 Netz ein und gleichzeitig Taste 'Fill' drücken, bis das Punktemuster in der Anzeige verschwindet.

Mit Hilfe der Tastatur kann das RAM auch über 'Diagnose key 7' initialisiert werden.

RAM init.

11.3 < GO >

RAM init. passed

The processor now checks without destruction the ON-chip-RAM and the OFF-chip-RAM of the 665 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

10.4 The test is breaked 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 >!

11. 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 10) 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:

11.1 Power off (wait for 5 s)

(all ext. connections removed!)

11.2 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 "Diagnosis key 7".

RAM init.

11.3 < GO >

RAM init. passed

11.4 < CLEAR >

DOS 0.000 ml

(Dosimat füllt)

Mit der RAM-Initialisierung werden die vorhandenen Daten im User-Memory und die Daten der Spezialfunktionen gelöscht und mit den untenstehenden Standard-Daten überschrieben:

Das User-Memory wird mit den Standard-Modi geladen.

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

Der Arbeitsspeicher wird mit dem Standardmodus DOS gefüllt. Die Spezialfunktionen des Dosimaten werden auf folgende Werte eingestellt:

```
Analogausgangsskala: 1 Hub pro 1000 mV
Senden RS 232:       off
Baudrate:            9600 Baud
autom. Füllen:       on
```

12. Fehlerliste

```
E02...E04: siehe 10. Endlos-RAM-Test
E10:       siehe  3. Diagnose Tastatur
E50:       siehe  6. Diagnose Digitaltimer
E51:       siehe  7. Diagnose Analogtimer
E55...E57: siehe  8. Diagnose Ext. Ein-
                     und Ausgänge
E90:       siehe  2. Diagnose Zylindercode
```

13. Uebersicht der Tastenzuordnung

(über Taste 9 bei Netz ein)

Für wiederholte Beobachtungen und spezielle Anwendungen kann es von Vorteil sein, direkt in eine Ueberprüfung einzusteigen. Im folgenden ist daher die Tastenzuordnung angegeben.

Taste/key	
0:	Zylinderkode
1:	Tastaturtest
2:	Anzeigetest
3:	Analogausgang
4:	Digitaltimer-Test
5:	Analogtimer-Test
6:	Extern Ein/Ausgänge
7:	RAM-Initialisierung

11.4 < CLEAR >

DOS 0.000 ml

(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 *
       5:      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
```

12. List of errors

```
E02...E04: see 10. endless-RAM-test
E10:       see  3. diagnosis of keyboard
E50:       see  6. diagnosis of digital timer
E51:       see  7. diagnosis of analogue
                   timer
E55...E57: see  8. diagnosis of ext.
                   inputs and outputs
E90:       see  2. diagnosis of cylinder
                   code
```

13. 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.

	siehe/see
"cylinder code "	2.
"keys test "	3.
"display test "	4.
"analog output "	5.
"timer dig. test "	6.
"timer ana. test "	7.
"extern in/output"	8.
"RAM init. "	11.

4. Remote control

4.1 General

The 665 Dosimat offers an extensive remote control. Data transmission occurs serial via an interface according to RS 232 C in half duplex procedure.

The syntax of the commands is based on the following principles:
- Commands are strings which always begin with a letter.
- Only the first three letters are significant, string length is unlimited.
- Actual parameters have to be separated by a space from the preceding command.
- The input range for numbers is -1E33 ... -1E-37, 0, 1E-37 ... 1E33.
  Examples of possible numbers: 3.567
  -.5
  5.E4
  -123.45E-12
- Set 'CR' + 'LF' at the end of a complete command.
  'CR': carriage return (ASCII sign No. 13)
  'LF': line feed (ASCII sign No. 10)
- All commands, where the Dosimat has to send data, begin with letter 'Q' (query).
- Each string sent by the Dosimat ends with 'CR' + 'LF'.
- Set handshake up for every character (asynchronous transfer).

There are several exeptions in order to avoid problems with time:
- The commands GO, STOP, FILL, CLEAR, and INFORMATION are so-called 1-byte commands. They are simply transmitted as 'G', 'S', 'F', 'C', and 'I'. No separating and terminating signs are necessary.
- With command 'I' (Information), the Dosimat sends two information bytes containing the information READY, CODE, LOCK, LIMIT etc. see 4.2.7.
- Several commands can be transmitted "live", i.e. during a running function. All other commands are recognised only if the Dosimat is in its ready state, see 4.2. If commands are not recognised, the corresponding error bytes of information byte 2 are set and may be inquired with command 'I'.

PC program for 665 Dosimat control, ordering number 6.6001.010

4.2 Control commands

Command	Explanation	Live Y/N	Notes
REMOTE ON	Remote control on	Y	4.2.1
REMOTE OFF	Remote control off	Y	4.2.2
G	GO	N	1-byte command 4.2.3
S	STOP	Y	1-byte command 4.2.4
F	FILL	Y	1-byte command 4.2.5
C	CLEAR volume display	N	1-byte command 4.2.6
I	Information	Y	1-byte command 4.2.7
DOS	Standard mode DOS	N	4.2.8
DIR	Standard mode DIS R	N	4.2.9
DIC	Standard mode DIS C	N	4.2.10
PIP	Standard mode PIP	N	4.2.11
DIL	Standard mode DIL	N	4.2.12
MDO	Mode DOS	N	Pervious param. 4.2.13
MDR	Mode DIS R	N	Pervious param. 4.2.14
MDC	Mode DIS C	N	Pervious param. 4.2.15
MPU ON	Mode PULSE on	N	Pervious param. 4.2.16
MPU OFF	Mode PULSE off	Y	Pervious param. 4.2.17
MSTORE X	Mode store	N	$0 \leq X \leq 9$, J 4.2.18
MRCALL X	Mode recall	N	$0 \leq X \leq 9$, J 4.2.19
PBLANK VALUE	Parameter blank	Y	4.2.20
PFACTOR VALUE	Parameter factor	Y	4.2.21
PSMPL VALUE	Parameter smpl	Y	4.2.22
UNIT X	Unit	Y	$0 \leq X \leq 9$, J, K 4.2.23
VUP VALUE	Rate up	Y	4.2.24
VDWN VALUE	Rate down	Y	4.2.25
VUA	Rate up analogue on	Y	4.2.26
VDA	Rate down analogue on	Y	4.2.27
VDS VALUE	Dispensing volume	N	4.2.28
VPIP VALUE	Pipetting volume	N	4.2.29
VDL VALUE	Diluting volume	N	4.2.30
VLIM VALUE	Limiting volume	N	4.2.31
VLIM OFF	Limiting volume off	N	4.2.32

Command	Function	Live Y/N	Notes
AFILL ON	Auto fill on	Y	4.2.33
AFILL OFF	Auto fill off	Y	4.2.34
QDISPLAY	Query display	Y	4.2.35
QVOLUME	Query volume (ml)	Y	4.2.36
QPOSITION	Query piston position	Y	4.2.37
QPROGRAM	Query program version	Y	4.2.38
QMODE	Query mode	Y	4.2.39
QPBLANK	Query blank	Y	4.2.40
QPFACTOR	Query factor	Y	4.2.41
QPSMPL	Query smpl	Y	4.2.42
QVUP	Query rate up	Y[1)]	4.2.43
QVDOWN	Query rate down	Y[1)]	4.2.44
QAUP	Query rate analog up on/off	Y	4.2.45
QADOWN	Query rate analog dwn on/off	Y	4.2.46
QDS VOLUME	Query dispensing volume	Y	4.2.47
QPIP VOLUME	Query pipetting volume	Y[1)]	4.2.48
QLIM VOLUME	Query limiting volume	Y	4.2.49
QDL VOLUME	Query diluting volume	Y[1)]	4.2.50
QUNIT	Query unit	Y	4.2.51
QAFILL	Query auto fill	Y	4.2.52

[1)] Use these commands in mode PIP and DIL only not live, i.e. if Dosimat is ready.

Below, every control command is described in detail:

4.2.1 REM ON — Remote on, live

Remote control on. Entries via keyboard are no more possible,the only accepted commands come from remote control. Calculations in mode DOS are carried out and displayed until the Dosimat is in its ready state (≥ 3 s). An eventual result transmission (QDISP) is terminated before the Dosimat has reached its ready state.

4.2.2 REM OFF — Remote off, live

Remote control off. Entries via keyboard are possible again.
With remote control off, remote control commands are not accepted any more.
Command "I" (Information) is active. Commands which contain an "I", such as VPI or VLI trigger the transmission of information bytes which blocks keyboard and remote control of 665 Dosimat until controler acknowledges transmission.

4.2.3 G GO, not live, 1-byte command

'GO' triggers dosing in all modes.
In mode DOS dosing goes on until a stop command is received.

4.2.4 S STOP, live, 1-byte command

'STOP' terminates dosing in modes DOS, DIS R and DIS C (not filling).

4.2.5 F FILL, live, 1-byte command

'FILL' triggers filling of the burette in all modes. May also serve as emergency stop.
If the exchange unit is already filled, filling is not executed.

4.2.6 C CLEAR, not live, 1-byte command

'CLEAR' resets volume display to 0.000 ml.

4.2.7 I Information, live, 1-byte command

Command 'I' (information) makes the Dosimat send information bytes terminated by 'CR' + 'LF'.
These information bytes contain the information READY, CODE, LOCK, LIMIT etc.
Command 'I' is also active at "REM OFF".

Information byte 1:

Bit	Function
0	Cylinder code
1	Cylinder code
2	Cylinder code
3	1 = no exch. unit
4	1 = New exchange unit
5	1 = Ready
6	1 = V-LIM reached
7	Parity (even)

Cylinder code:

Bit	1 ml	5 ml	10 ml	20 ml	50 ml
0	0	1	1	1	1
1	1	0	1	0	1
2	1	0	1	1	0

Information byte 2:

Bit	Function
0	1 = Wrong command code
1	1 = Parameter corrected to its limit value
2	1 = Repete command in the READY state
3	1 = Cylinder empty
4	1 = Remote control on
5	1 = Data transfer on (send RS232 on)
6	Reserve
7	Parity (even)

4.2.8 DOS — Mode DOS, not live

Selection of standard mode DOS.The standard parameters (depending on the exchange unit) are loaded into the working memory. If the exchange unit is not filled, filling is executed.

4.2.9 DIS R — Mode DIS R, not live

Selection of standard mode DIS R.The standard parameters (depending on the exchange unit) are loaded into the working memory. If the exchange unit is not filled, filling is executed.

4.2.10 DIS C — Mode DIS C, not live

Selection of standard mode DIS C.The standard parameters (depending on the exchange unit) are loaded into the working memory. If the exchange unit is not filled, filling is executed.

4.2.11 PIP — Mode PIP, not live

Selection of standard mode PIP.The standard parameters (depending on the exchange unit) are loaded into the working memory. If the exchange unit is not filled, filling is executed.

4.2.12 DIL — Mode DIL, not live

Selection of standard mode DIL.The standard parameters (depending on the exchange unit) are loaded into the working memory. If the exchange unit is not filled, filling is executed.

4.2.13 MDO — Mode DOS with previous parameters, not live

Selection of mode DOS without changing the actual parameters in the working memory. No filling of the exchange unit.

4.2.14 MDR — Mode DIS R with previous parameters, not live

Selection of mode DIS R without changing the actual parameters in the working memory. No filling of the exchange unit.

4.2.15 MDC Mode DIS C with previous parameters, not live

Selection of mode DIS C without changing the actual parameters in the working memory. No filling of the exchange unit.

4.2.16 MPU ON Mode PULSE on, not live

Mode PULSE on.
Mode PULSE is not equivalent to modes DOS, DIS R, DIS C, PIP or DIL. Mode PULSE runs before one of these modes. The parameters in the working memory remain unchanged and no filling is executed.
In mode PULSE, 1/10 000 V(B) is dosed with every 'GO'. The maximal frequency of GO-commands is ≤ 500 Hz. This is equal to to the maximum rate of 1 V(B)/20 s.
Note: It is advantageous to run mode PULSE before mode DOS or DIS C, because in these two modes V-LIM is active. Mode PULSE has to be left with "MPU OFF".

4.2.17 MPU OFF Mode PULSE off, not live

Mode PULSE off. The background mode is re-activated in the working memory. No parameters are changed and no filling is executed.

4.2.18 MST X Mode store under address X, not live

X = 0... 9, J
Storing the actual mode with the corresponding parameters under address X. The content of the working memory remains unchanged.
Store J is only accessible via remote control and serves e.g. to store the actual mode after "REM ON".

4.2.19 MRC X Mode recall with address X, not live

X = 0 ... 9, J
Recalling a mode with the corresponding parameters from the user memory.
Mode CNT D is not loaded into the working memory and bit 0 of information byte 2 is set to 1.

4.2.20 PBL VALUE Parameter 'blank', live

Value = -999.999 ... + 999.999
Setting blank in ml.
In mode DOS only, in other modes, the command is not accepted and bit 0 of information byte 2 is set.

4.2.21 PFA VALUE Parameter 'factor', live

Value = -1E33 ... -1E-37 , 0 , 1E-37 ... 1E33
Setting factor.
In mode DOS only, in other modes, the command is not accepted and bit 0 of information byte 2 is set to 1.

4.2.22 PSM VALUE Parameter 'smpl', live

Value = -1E33 ... -1E-37 , 0 , 1E-37 ... 1E33
Setting sample size.
In mode DOS only, in other modes, the command is not accepted and bit 0 of information byte 2 is set to 1.

4.2.23 UNI X Unit, live

X = 0 ... 9, J, K
Selecting the unit:

X = 0, %
X = 1, g
X = 2, mg
X = 3, g/l
X = 4, mg/l
X = 5, mol
X = 6, mol/l
X = 7, ml
X = 8, l
X = 9, /pc (per piece)
X = J, no unit
X = K, ppm

In mode DOS only, in other modes, the command is not accepted and bit 0 of information byte 2 is set to 1.

4.2.24 VUP VALUE Rate up, live

Value = 0.001 ... 150.0
Setting rate up in ml/min.
If rate up is set to 'analogue', it is changed automatically to rate up digital.
Input range depends on the cylinder volume of the exchange unit:

Cylinder ml	rate $_{min}$ ml/min	rate $_{max}$ ml/min
1	0.001	3
5	0.005	15
10	0.010	30
20	0.020	60
50	0.050	150

If a value is entered which is too high or too low, resp., the Dosimat corrects the value automatically to rate $_{max}$ or rate $_{min}$, resp. and sets bit 1 of information byte 2 to 1 (see 4.2.7). To set rate $_{max}$, it is therefore possible to always enter 150 ml/min.

4.2.25 VDW VALUE Rate down, live

Value = 0.001 ... 150.0
Setting rate down in ml/min.
If rate down is set to 'analogue', it is changed automatically to rate down digital.

Input range depends on the cylinder volume of the exchange unit:

Cylinder ml	rate min ml/min	rate max ml/min
1	0.001	3
5	0.005	15
10	0.010	30
20	0.020	60
50	0.050	150

If a value is entered which is too high or too low, resp., the Dosimat corrects the value automatically to rate $_{max}$ or rate $_{min}$, resp. and sets bit 1 of information byte 2 to 1 (see 4.2.7). To set rate $_{max}$, it is therefore possible to always enter 150 ml/min.

4.2.26 VUA Rate up analog, live

Setting rate control to 'up analogue' (control via potentiometer (4)).
A set value (VUP VALUE) is overwritten.

4.2.27 VDA Rate down analog, live

Setting rate control to 'down analogue' (control via potentiometer (4)).
A set value (VDW VALUE) is overwritten.

4.2.28 VDS VALUE Dispensing volume, not live

Value = 0.001 ... 999.999
Setting the dispensing volume in ml.
In modes DIS R and DIS C only, in other modes the command is not accepted and bit 0 of information byte 2 is set to 1.
The entry is automatically corrected to a multiple of 1/10 000 V(B) depending on the volume of the cylinder:

Cylinder ml	Volume min ml	Volume max ml
1	0.001	999.999
5	0.001	999.999
10	0.001	999.999
20	0.002	999.999
50	0.005	999.999

If a value is entered which is too high or too low, resp., the Dosimat corrects it automatically to volume $_{max}$ or volume $_{min}$, resp. and sets bit 1 of information byte 2 to 1 (see 4.2.7).

4.2.29 VPI VALUE Pipetting volume, not live

Value = 0.001 ... 49.500
Setting the pipetting volume in ml.
In modes PIP and DIL only, in other modes the command is not accepted and bit 0 of information byte 2 is set to 1.

The entry is automatically corrected to a multiple of 1/10 000 V(B) depending on the volume of the cylinder:

Cylinder ml	Volume min ml	Volume max ml
1	0.001	0.900
5	0.001	4.900
10	0.001	9.800
20	0.002	19.700
50	0.005	49.500

If a value is entered which is too high or too low, resp. , the Dosimat corrects it automatically to volume $_{max}$ or volume $_{min}$, resp. and sets bit 1 of information byte 2 to 1 (see 4.2.7).

4.2.30 VDL VALUE Diluting volume, not live

Value = 0.001 ... 999.999
Setting the diluting volume in ml.
In mode DIL only, in other modes the command is not accepted and bit 0 of information byte 2 is set to 1.
The entry is automatically corrected to a multiple of 1/10 000 V(B) depending on the volume of the cylinder:

Cylinder ml	Volume min ml	Volume max ml
1	0.001	999.999
5	0.001	999.999
10	0.001	999.999
20	0.002	999.999
50	0.005	999.999

If a value is entered which is too high or too low, resp. , the Dosimat corrects it automatically to volume $_{max}$ or volume $_{min}$, resp. and sets bit 1 of information byte 2 to 1 (see 4.2.7).

4.2.31 VLI VALUE Security volume, not live

Value = 0.001 ... 999.999
Setting the security volume in ml.
In modes DOS, DIS C, and PULSE only, in other modes the command is not accepted and bit 0 of information byte 2 is set to 1.

The entry is automatically corrected to a multiple of 1/10 000 V(B) depending on the volume of the cylinder:

Cylinder ml	Volume $_{min}$ ml	Volume $_{max}$ ml
1	0.001	999.999
5	0.001	999.999
10	0.001	999.999
20	0.002	999.999
50	0.005	999.999

If a value is entered which is too high or too low, resp. , the Dosimat corrects it automatically to volume $_{max}$ or volume $_{min}$, resp. and sets bit 1 of information byte 2 to 1 (see 4.2.7).

4.2.32 VLI OFF — Security volume off, not live

Security volume control is switched off.
In modes DOS, DIS C, and PULSE only, in other modes the command is not accepted and bit 0 of information byte 2 is set to 1.
The value of V-LIM is overwritten.

4.2.33 AFI ON — Auto fill on, live

Function 'auto fill' is switched on.

4.2.34 AFI OFF — Auto fill off, live

Function 'auto fill'is switched off.

4.2.35 QDI — Query display, live

Request to send content of display via RS232 interface.
For example: "DIS C 13.457 ML 'CR' 'LF'"

4.2.36 QVO — Query volume value, live

Request to send the volume value via RS232 interface.
For example: " 13.457 'CR' 'LF'"

4.2.37 QPO — Query position of piston, live

Request to send the content of the position counter via RS232 interface.
The position counter (16 bit binary) gives the actual position of the piston.
0 = Initial position (filled)
10 000 = Final, position (empty)

The binary value is transmitted in 4 bytes, where only the low-order nibble of a byte contains a 4 bit information.

1nd byte: $2^0 \ldots 2^3$
2nd byte: $2^4 \ldots 2^7$
3rd byte: $2^8 \ldots 2^{11}$
4th byte: $2^{12} \ldots 2^{15}$
5th byte: 'CR'
6th byte: 'LF'

Note: bytes 1...4 may have the value of 'CR' + 'LF' (0DH, 0AH)!

4.2.38 QPR Query program version, live

Request to send the program version via RS232 interface.
For example: "Prog 020 DD 010 'CR' 'LF'"

4.2.39 QMO Query mode, live

Request to send the mode via RS232 interface.
For example: "DIS C 'CR' 'LF'"

4.2.40 QPB Query parameter 'blank', live

Request to send the parameter 'blank' via RS232 interface.
For example: "7.368 'CR' 'LF'"

4.2.41 QPF Query parameter 'factor', live

Request to send the parameter 'factor' via RS232 interface.
For example: "-7.14578E-12 'CR' 'LF'"

4.2.42 QPS Query parameter 'smpl', live

Request to send the parameter 'smpl' via RS232 interface.
For example: "23.75 'CR' 'LF'"

4.2.43 QVU Query rate up, live

Request to send the value for rate up via RS232 interface.
For example: "37.5 'CR' 'LF'"
If rate is set to 'analogue up', 1E34 is transmitted.

4.2.44 QVD Query rate down, live

Request to send the value for rate down via RS232 interface.
For example: "37.5 'CR' 'LF'"
If rate is set to 'analogue down', 1E34 is transmitted.

4.2.45 QAU Query rate up 'analogue on/off', live

Request to send the information rate up 'analogue on/off' via RS232 interface.
For example: Analogue on "on 'CR' 'LF'"
Analogue off " off 'CR' 'LF'"

4.2.46 QAD Query rate down 'analogue on/off', live

Request to send the information rate down 'analogue on/off' via RS232 interface.
For example: Analogue on "on 'CR' 'LF'"
Analogue off " off 'CR' 'LF'"

4.2.47 QDS Query dispensing volume, live

Request to send the dispensing volume via RS232 interface.
For example: "1.275 'CR' 'LF'"
Transmission is only possible in modes DIS R and DIS C.
In other modes, string "not defined 'CR' 'LF'" is transmitted.

4.2.48 QPI Query pipetting volume, live

Request to send the pipetting volume via RS232 interface.
For example: "1.275 'CR' 'LF'"
Transmission is only possible in modes PIP and DIL.
In other modes, string "not defined 'CR' 'LF'" is transmitted.

4.2.49 QLI Query limit volume, live

Request to send the limit volume via RS232 interface.
For example: "1.275 'CR' 'LF'"
If V-LIM is 'off', the string "OFF 'CR' 'LF'" is transmitted.
Transmission is only possible in modes DOS and DIS C.
In other modes, string "not defined 'CR' 'LF'" is transmitted.

4.2.50 QDL Query diluting volume, live

Request to send the diluting volume via RS232 interface.
For example: "1.275 'CR' 'LF'"
Transmission is only possible in mode DIL.
In other modes, string "not defined 'CR' 'LF'" is transmitted.

4.2.51 QUN Query unit, live

Request to send the unit via RS232 interface.
For example: "mg/l 'CR' 'LF'"
Transmission is only possible in modes DIS R and DIS C.
In other modes, string "not defined 'CR' 'LF'" is transmitted.

4.2.52 QAF Query 'auto fill on/off', live

Request to send the information 'auto fill on/off' via RS232 interface.
For example: auto fill on "on 'CR' 'LF'"
auto fill off "off 'CR' 'LF'"

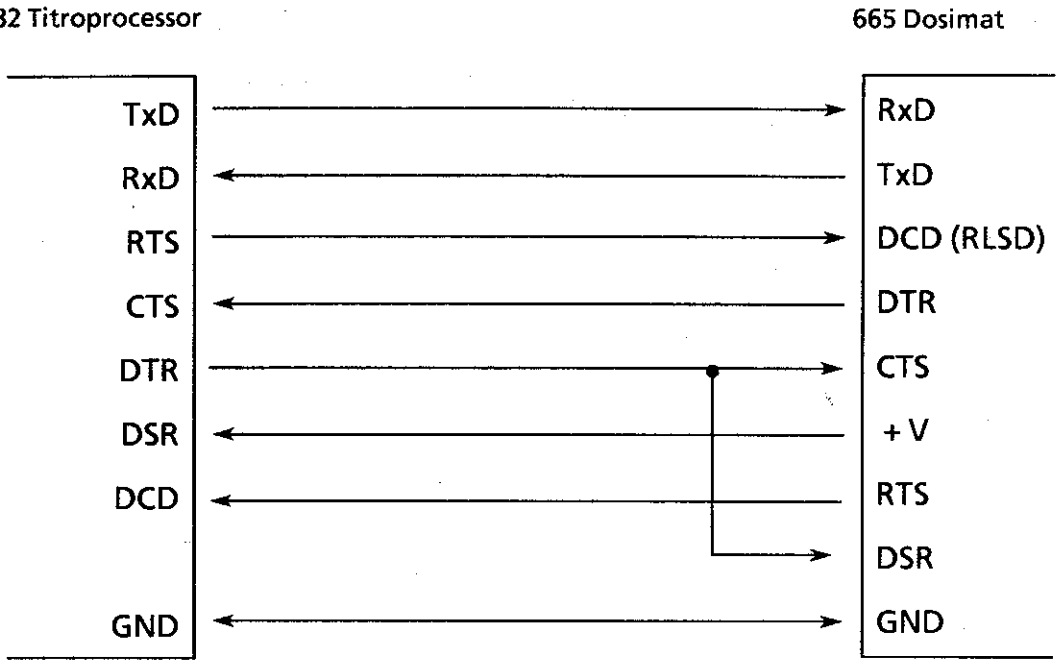
4.3 Combination with other instruments

Cables:
Use only shielded data cable (e.g. D.104.0201 from METROHM) for interconnections of the 665 Dosimat with METROHM (or other) instruments. The cable shield has to be grounded effectively on both instruments. Be aware of current loops!
The maximum cable length is app. 20 m.

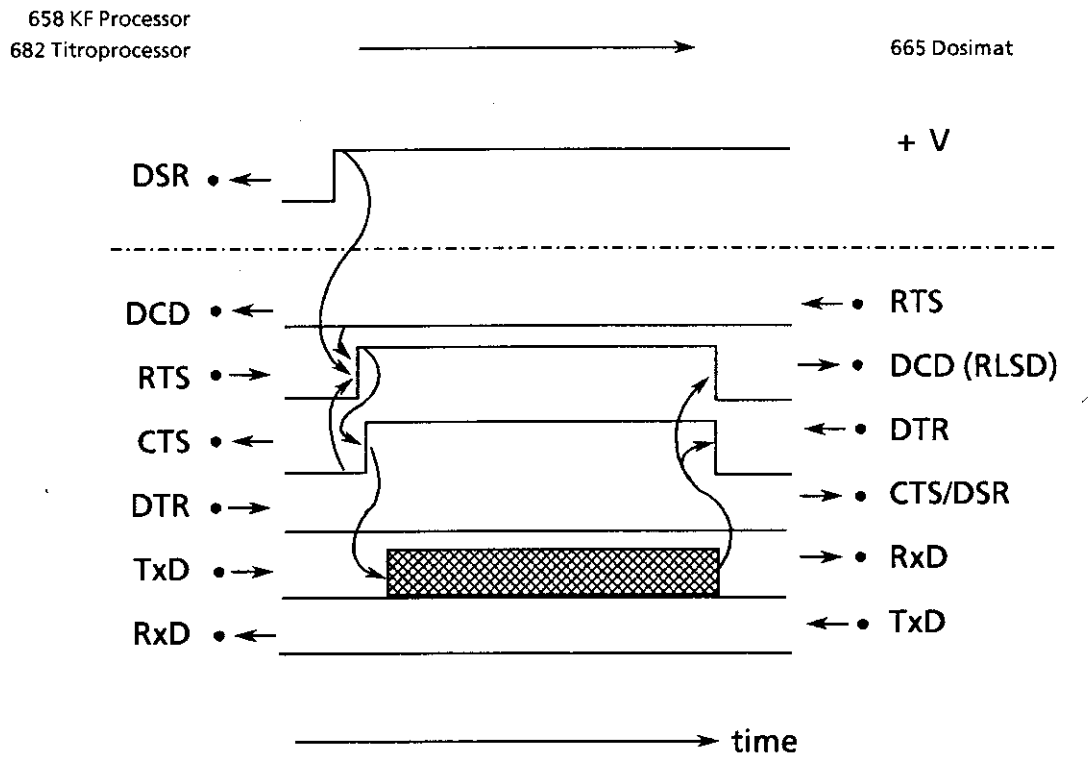
Plugs:
Use only effectively shielded plugs (e.g. K.101.0004 or K.210.0002 with K.210.9004 from METROHM).

Connection of 658 KF Processor or 682 Titroprocessor with 665 Dosimat:

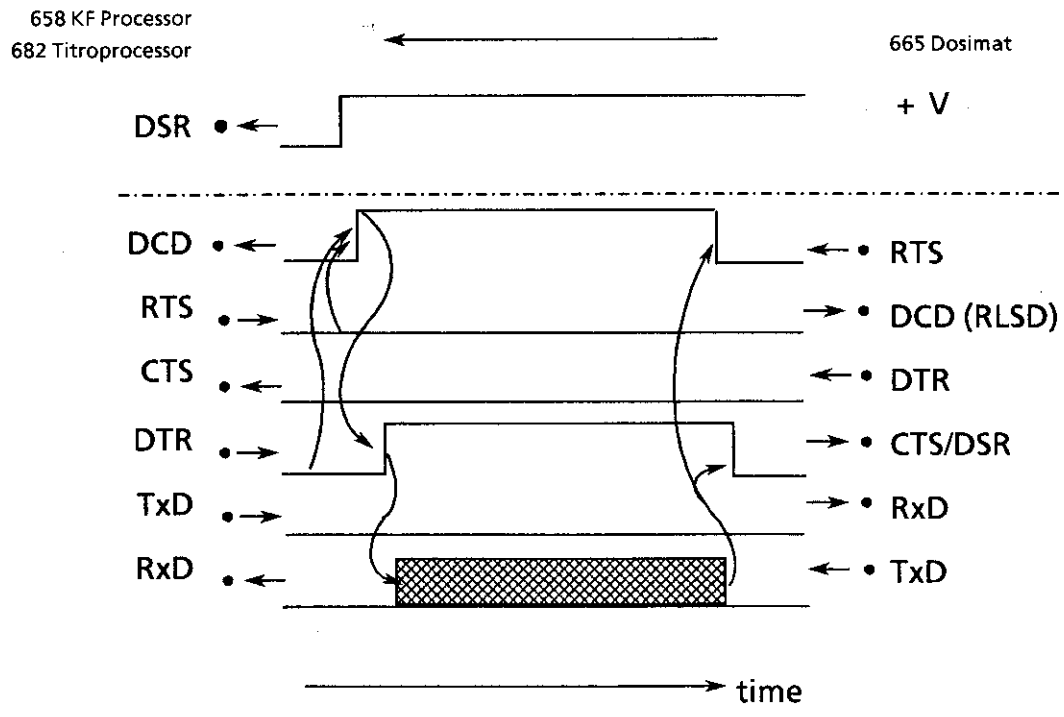
Wiring



Timing, 665 Dosimat as receiver



Timing, 665 Dosimat as transmitter

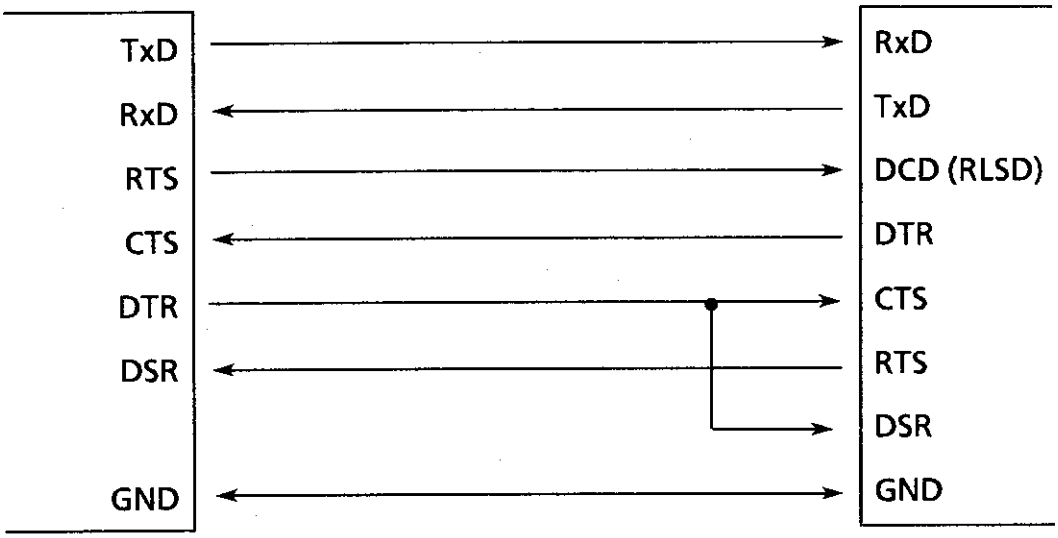


Connection of 646 VA Processor with 665 Dosimat

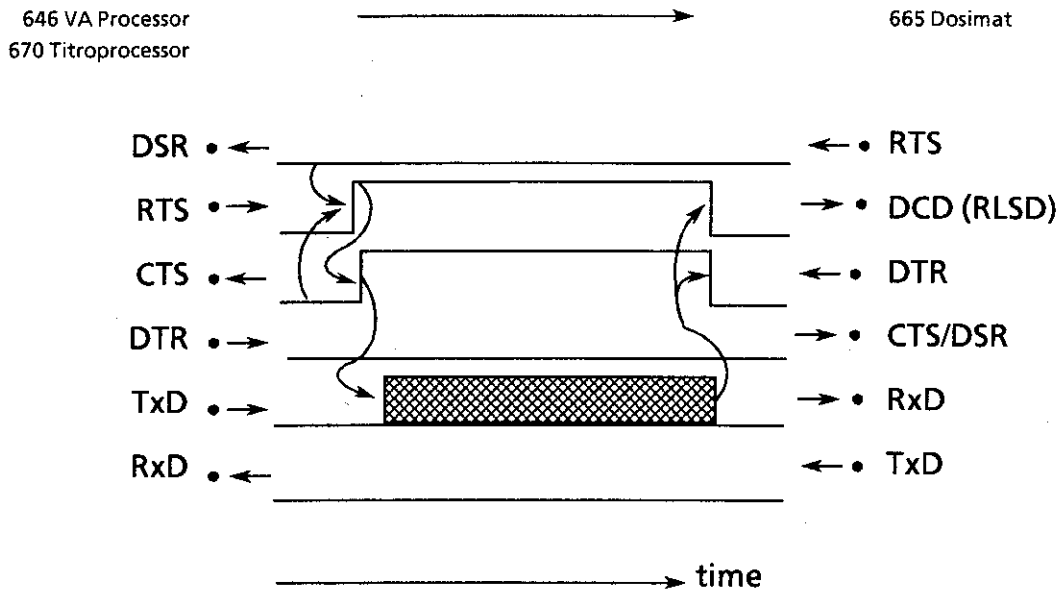
Wiring

646 VA Processor
670 Titroprocessor

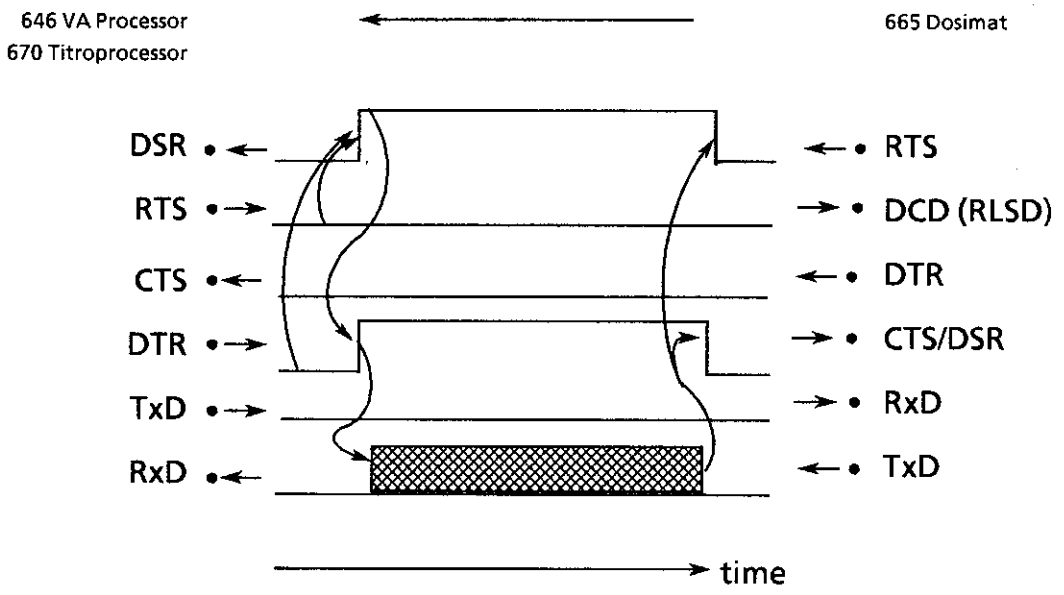
665 Dosimat



Timing, 665 Dosimat as receiver

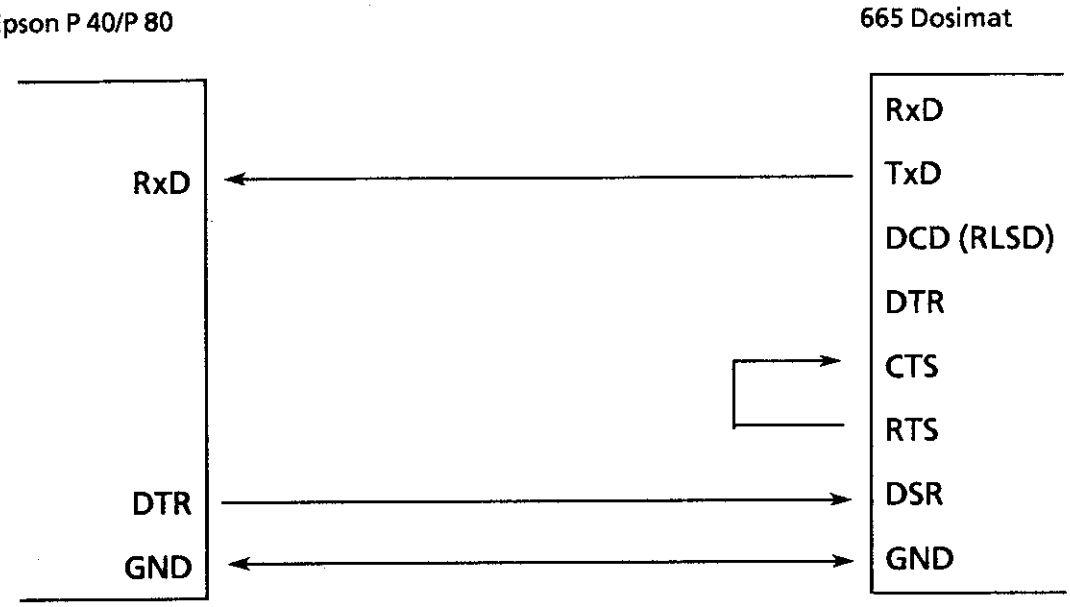


Timing, 665 Dosimat as transmitter

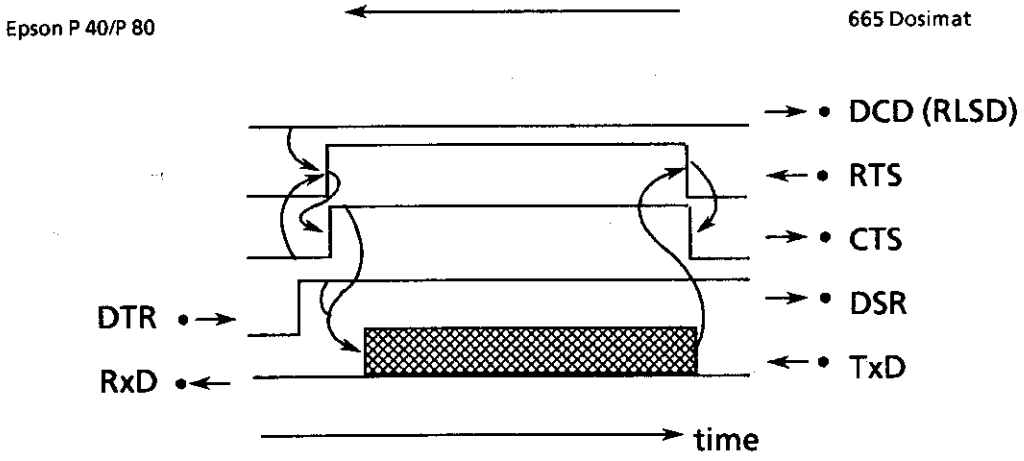


Connection of Printer "EPSON P40/P 80" with 665 Dosimat

Wiring

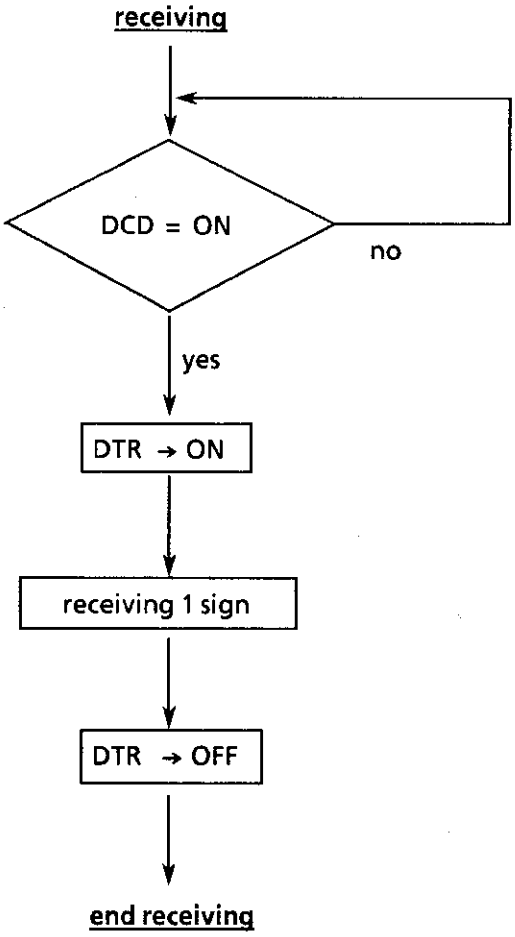


Timing , 665 Dosimat as transmitter

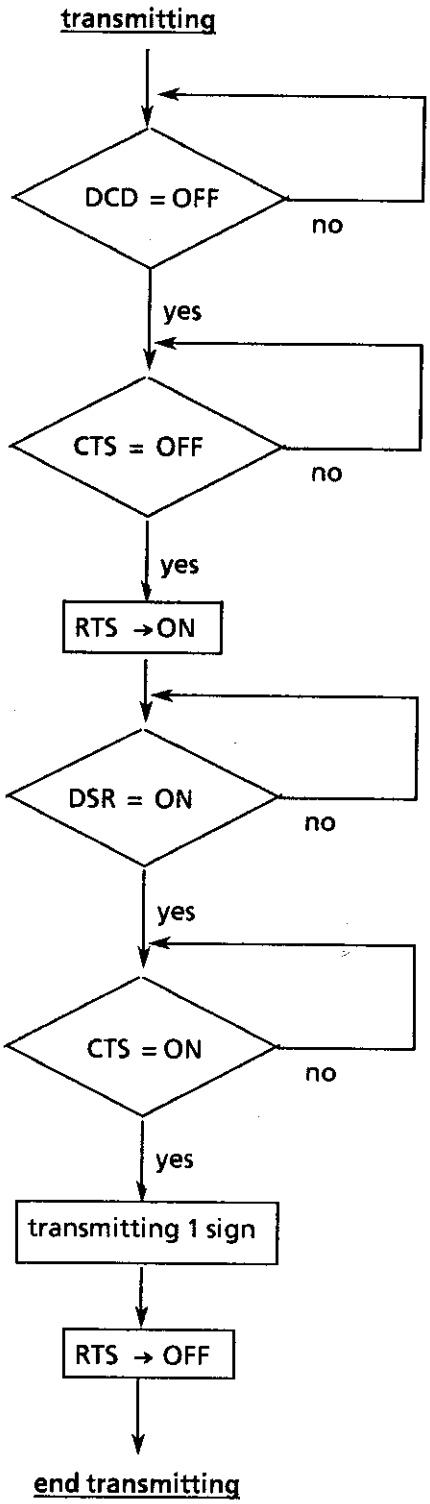


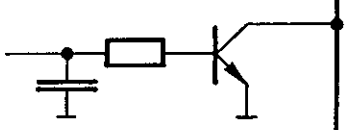
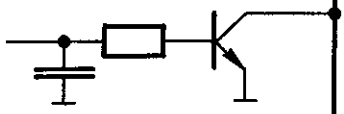
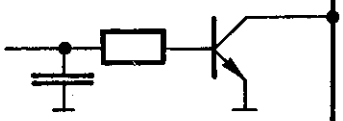
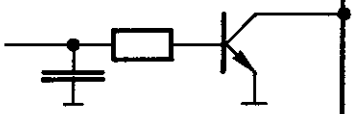
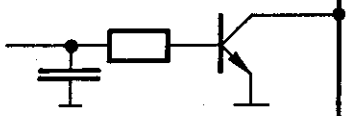
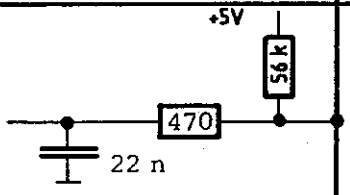
4.4 Structure of the program

Structure with 665 Dosimat as receiver



Structure with 665 Dosimat as transmitter



	3.665.0090	extern
Bereit/ Ready Dosimat bereit. Dosimat nicht beschäftigt. Dosimat ready. Dosimat is not busy.		A18 V_{CE} 30 V I_C 20 mA bereit / ready = L
Grenzvolumen/Limit volume Grenzvolumen erreicht. Limit volume reached.		A16 V_{CE} 30 V I_C 20 mA erreicht / reached = L
Dosierung beendet Job End Endeimpuls nach abgeschlossenem Dosiervorgang. End pulse after feeding is completed.		A9 V_{CE} 30 V I_C 20 mA  tp ca, 150 ms
Reserve-Ausgang Spare Output		A10 V_{CE} 30 V I_C 20 mA
Impulse/Pulses (10'000) 10'000 Volumenimpulse. Erscheinen nur beim Dosieren. 10'000 volume pulses. Appear with "feed" only.		A7 V_{CE} 30V I_C 20 mA  tp ca, 200 µs
Reserve-Eingang Spare Input		A15 Eingangspegel und -Ströme: Input levels and currents: $V_{IL} \leq 0.4$ V $V_{IH} \geq 2$ V $I_{IL} \leq 0.6$ mA

Stk.	Artikelbezeichnung	Pos.	Dimension / Artikelnummer	Oberfläche	Bemerkungen

für Geräte / Baugruppe

Aend.

Blatt 1
6 Blätter

Artikel: Steuer-Ein- und Ausgänge
Control inputs and outputs

Gez. 8.5.85 S.S

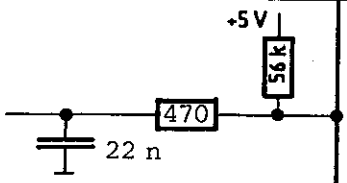
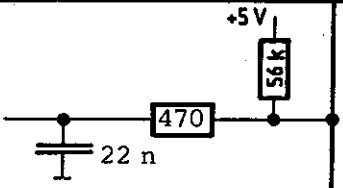
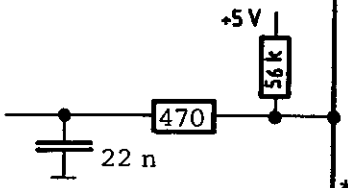
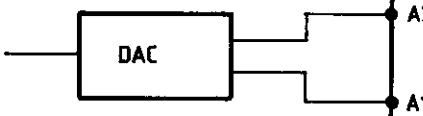
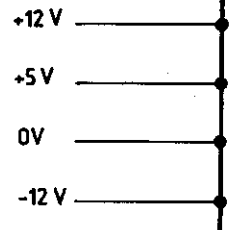
Gepr. Hn

Massst. Ers.für

Serie Ers.durch

3.665.0090

F Kennz. Bl.Nr 4 E 1

	3.665.0090	extern
Füllen/Fill Füllbefehl, ist während des Betriebs wirksam. Filling command, is active during operation.		füllen fill = L *  tp ≥ 1ms
Dosieren/Feed Mode DOS: Dosiertaste/ feeding button übrige Modi/ other modes: Impuls löst Dosierung aus/ pulse starts feeding		dosieren to feed = L *  tp ≥ 1ms
Schrittbetrieb Step operation Umschaltung auf Schrittbetrieb. 1 Dosierimpuls an A20 bewirkt 1/10'000 Volumeninkrement. Change to step operation. 1 dosing pulse at A20 triggers 1/10'000 of burette volume.		Schrittbetrieb Step operation = L * Eingangspegel und - Ströme: Input levels and currents: $V_{IL} \leq 0.4$ V $V_{IH} \geq 2$ V $I_{IL} \leq 0.6$ mA
Analogausgang "Volumen" Analog Output "Volume"		0mV ÷ 1000 mV $I_L \leq 5$ mA analog GND
Spannungen/Voltages		$I_L \leq 30$ mA $I_L \leq 80$ mA $I_L \leq 30$ mA

Stk.	Artikelbezeichnung	Pos.	Dimension / Artikelnummer	Oberfläche	Bemerkungen

für Geräte / Baugruppe

Aend.

Blatt 2
6 Blätter

Artikel: Steuer-Ein- und Ausgänge
Control inputs and outputs

Gez. 8.5.85 S.S

Gepr.

Massst. Ers.für

Serie Ers.durch

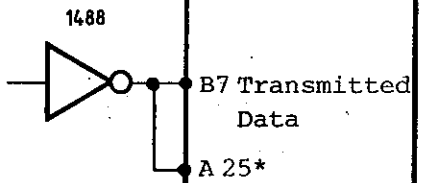
3.665.0090

F Kennz. Bl.Nr 4 E 2

EIA RS-232 C Schnittstelle
EIA RS-232 C Interface

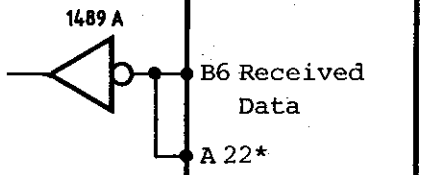
Sendedaten (TxD). Erfolgt keine Datenübertragung, wird die Leitung im Zustand "EINS" gehalten. Daten werden nur gesendet, wenn CTS und DSR im "EIN" Zustand und RLSD im "Aus" Zustand sind.

Transmitted Data (TxD). TxD is hold in marking condition if there is no data transfer. A data transfer occurs only if CTS and DSR are in ON condition, and RLSD in OFF condition.



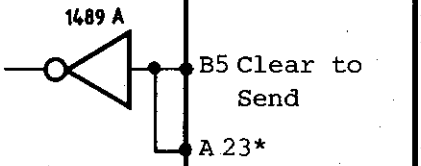
Empfangsdaten (RxD). Daten werden nur empfangen, wenn RLSD im "EIN" Zustand ist.

Received Data (RxD). Data are only accepted if RLSD is in ON condition.



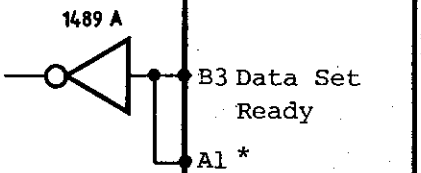
Sendebereitschaft (CTS)
EIN Zustand: Gegenstation ist bereit, Daten zu empfangen.

Clear to Send (CTS)
ON condition: The connected device is ready to accept data.



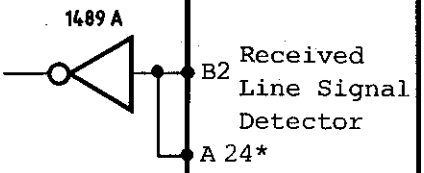
Betriebsbereitschaft (DSR)
EIN Zustand: Die Uebertragungsleitung ist angeschlossen.

Data Set Ready (DSR)
ON condition: Communication channel is connected.



Empfangssignalpegel (RLSD)
EIN Zustand: Gegenstation ist bereit, Daten zu senden.

Received Line Signal Detector (RLSD)
ON condition: The connected device is ready to send data.



* s. Seite 4E6
see page 4E6

Stk.	Artikelbezeichnung	Pos.	Dimension / Artikelnummer	Oberfläche	Bemerkungen

für Geräte / Baugruppe

Aend.

Blatt 3
6 Blätter

Artikel Steuer-Ein- und Ausgänge
Control inputs and outputs

Gez. 8.5.85 S.S
Gepr. Hu

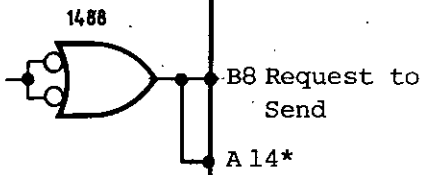
Massst. Ers.für
Serie Ers.durch

3.665.0090 F 4E3 Kennz. Bl.Nr

RS 232 C (Fortsetzung)
(continued)

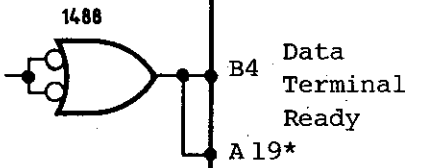
Sendeteil einschalten (RTS)
EIN Zustand: Dosimat ist bereit, Daten zu senden.

Request to Send (RTS)
ON condition: Dosimat is ready to send data.

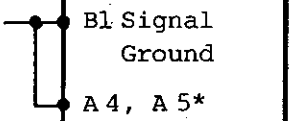


Interface bereit (DTR)
EIN Zustand: Dosimat ist bereit, Daten zu empfangen.

Data Terminal Ready (DTR)
ON condition: Dosimat is ready to accept data.



Betriebserde
Signal Ground



Schutzerde. Direkte Verbindung vom Kabelstecker zur Schutzerde des Gerätes.

Protective Ground. Direct connection from the cable plug to the protective ground of the device.

* s. Seite 4E6
see page 4E6

Stk.	Artikelbezeichnung	Pos.	Dimension / Artikelnummer	Oberfläche	Bemerkungen

für Geräte / Baugruppe

Aend.

Blatt 4
6 Blätter

Artikel Steuer-Ein- und Ausgänge
Control inputs and outputs

Gez. 8.5.85 S.S

Gepr.

Massst. Ers.für

Serie Ers.durch

3.665.0090

F Kennz. Bl.Nr 4E4

RS-232 C (Fortsetzung)
(continued)

Polaritätszuordnung der Signale

- Datenleitungen (TxD, RxD)

  Spannung negativ (<-3 V): Signalzustand "EINS"
  Spannung positiv (>+3 V): Signalzustand "NULL"

- Steuer- oder Meldeleitungen (CTS, DSR, RLSD, RTS, DTR)

  Spannung negativ (<-3 V): AUS Zustand
  Spannung positiv (>+3 V): EIN Zustand

Im Uebergangsbereich von +3 V bis -3 V ist der Signalzustand undefiniert.

Definition of Signal States

- data interchange circuits (TxD, RxD)

  negative voltage (<-3 V): marking condition
  positive voltage (>+3 V): spacing condition

- timing and control interchange circuits (CTS, DSR, RLSD, RTS, DTR)

  negative voltage (<-3 V): OFF condition
  positive voltage (>+3 V): ON condition

The signal state is undefined for voltages in the transition region between +3 V and -3 V.

Treiber / Driver	1488	gemäss EIA RS-232 C Spezifikation in conformance with the specifications of EIA standard No. RS-232 C
Empfänger / Receiver	1489	

Stk.	Artikelbezeichnung	Pos.	Dimension / Artikelnummer	Oberfläche	Bemerkungen

für Geräte / Baugruppe

Aend.

Blatt 5
6 Blätter

Artikel: Steuer-Ein- und Ausgänge
Control inputs and outputs

Gez. 8.5.85 S.S

Gepr.

Massst. Ers.für

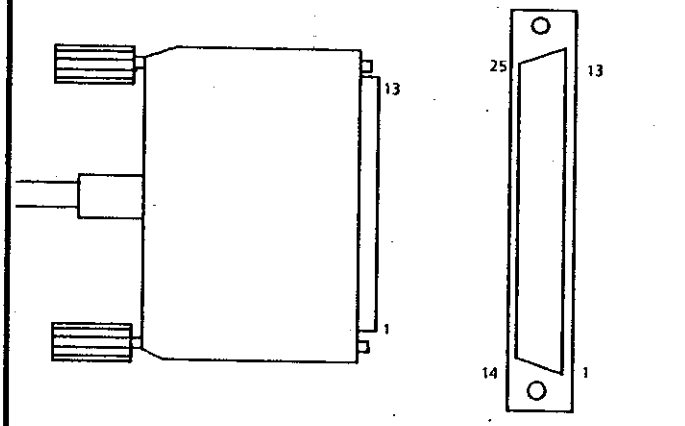
Serie Ers.durch

3.665.0090

F Kennz. Bl.Nr 4E5

3.665.0090	extern	Funktion/Function 665

Kontaktanordnung am Stecker für Buchse A/
Contact location at the plug of socket A



Auf Stecker-Lötseite gesehen
View to pin soldering side

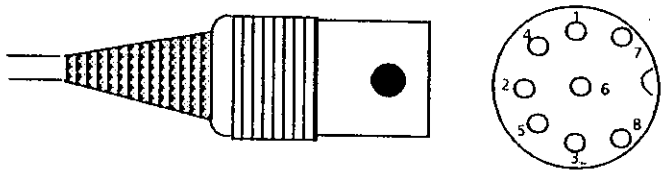
Bestellnummern/ordering numbers: K.210.9004/
K.210.0002

Stecker A

* Achtung: Die Anschlussnummern am Stekker A sind nicht gemäss RS 232-Standard belegt. Daher am Stecker keine RS 232-Standardkabel anschliessen.

* Please mind: The pin numbers of plug A are not used according to RS 232 standard version. Therefore do not plug in RS 232 standard cables.

Kontaktanordnung am Stecker für Buchse B/
Contact location at the plug for socket B



Bestellnummer/ordering number: K.101.0004

Datum/date
8.7.86

Metrohm

Steuer-Ein- und Ausgänge/Control Inputs and Outputs

5. 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.

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

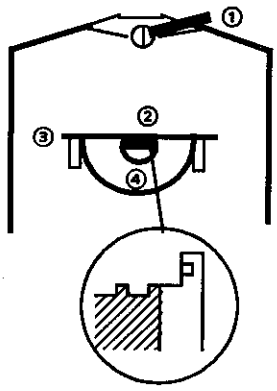


Fig. 5-1: Bottom view

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. 5-5, page 71.

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.

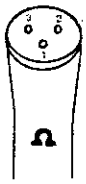
The holder on the right serves to hold the burette tip; in the holder on the left you can store the electrode associated with the reagent, for example.

5.2 Assembly of other models

See also Fig. 5-6 to 5-8, pages 72-74
- 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 5.5), 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:

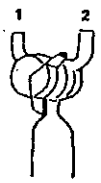
Models 6.3006.XXX/6.3007.XXX

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. 5-2: 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.

5.3 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.

5.4 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.

5.5 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 stococck:
- 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.

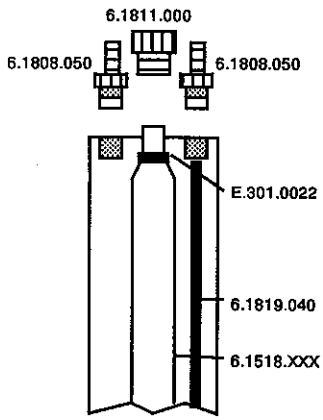
PTFE cock of models 6.3005.XXX and 6.3004.XXX

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.

5.6 Mounting the thermostat jacket of 6.3011.XXX/6.3012.XXX Exchange Units



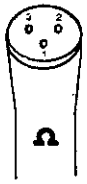
1. Undo tubing connection of 6.1518.XXX Glass Cylinder.
2. Remove light protection.
3. Unscrew 6.1811.000 Screw Fitting at glass fitting.
4. Roll O-ring upwards out of groove on glass fitting. Do not use any hard objects to remove the O-ring, otherwise the edge of the glass fitting can splinter! If all 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 5-3: Thermostat jacket

5.7 6.3006.113 Micro-model – 1 ml

Assembly:
See also Fig. 5-9, page 75
- 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. 5-4: 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).

5.8 Ordering designations

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

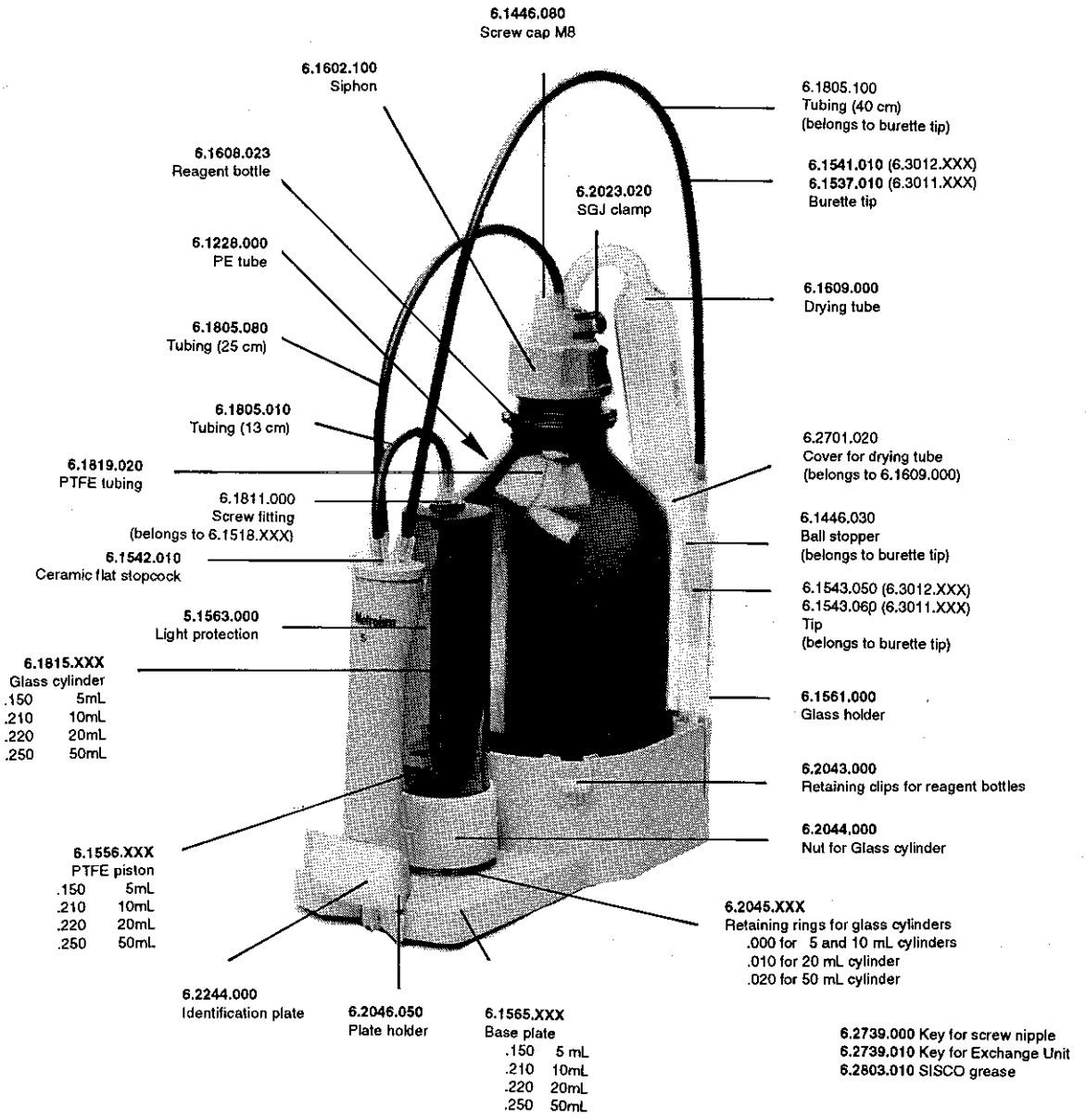


Fig. 5-5: Standard accessories and ordering designations for 6.3012.XXX and 6.3011.XXX Exchange Units

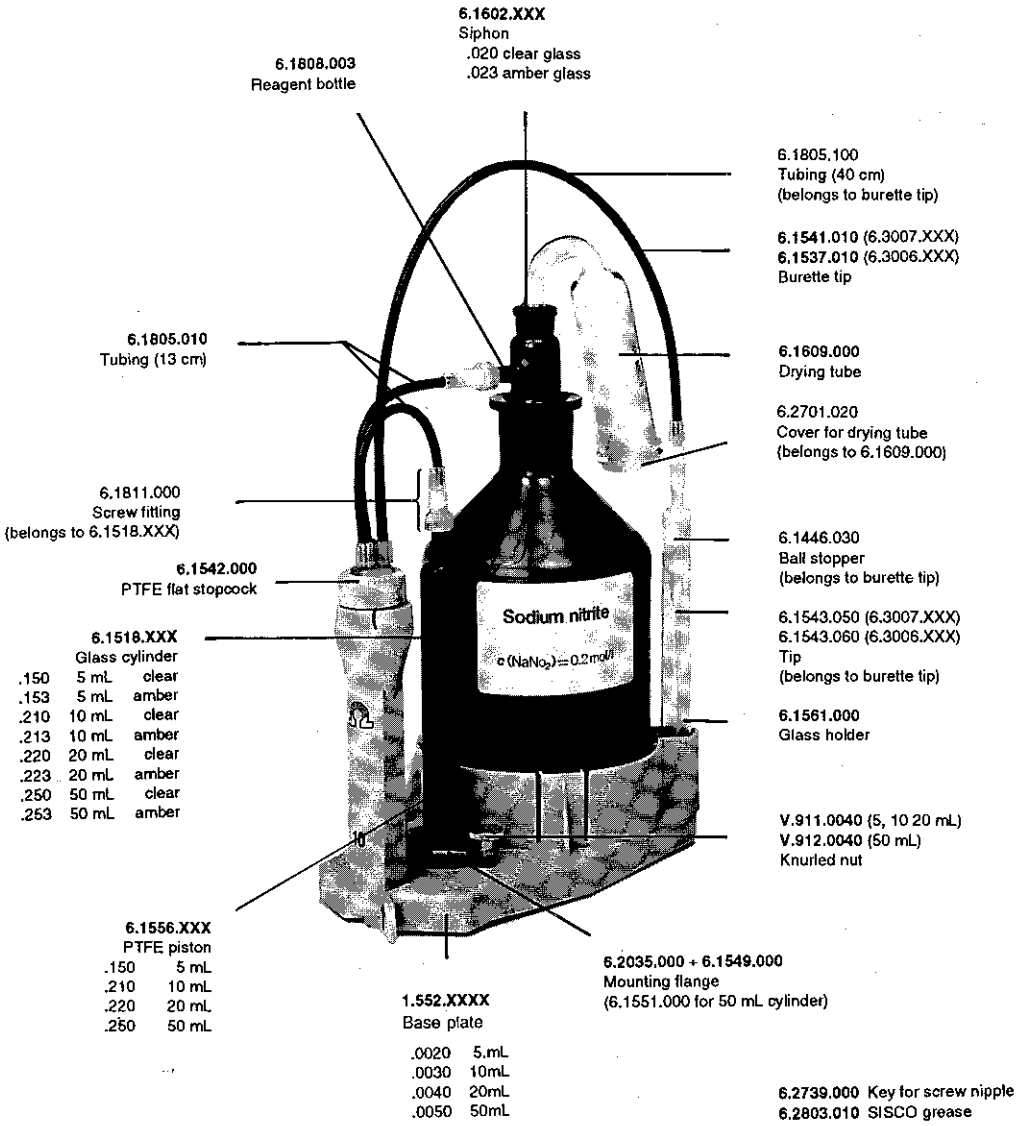


Fig. 5-6: Standard accessories and ordering designations for 6.3007.XXX and 6.3006.XXX Exchange Units

5.8.2 Models 6.3005.XXX and 6.3004.XXX

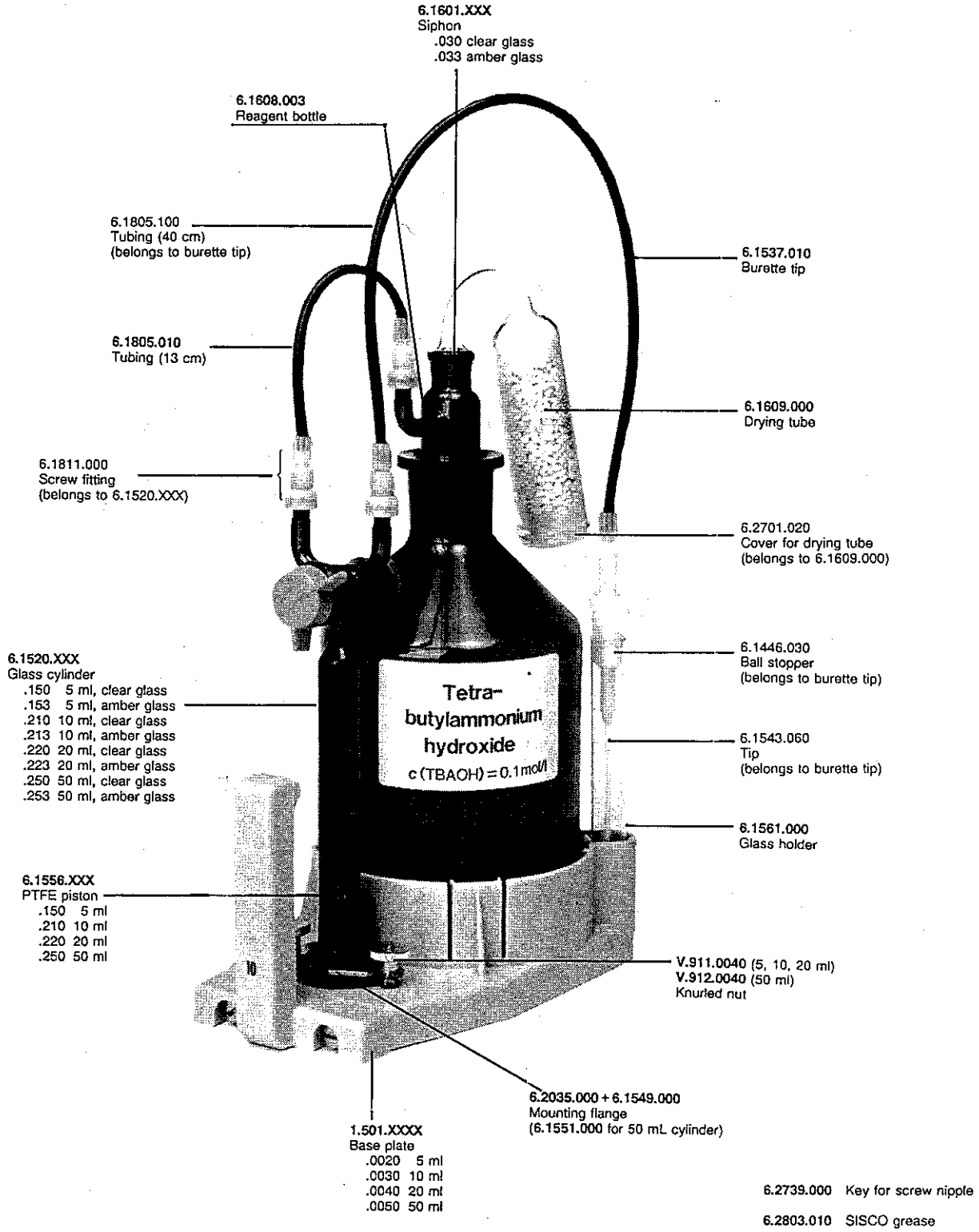


Fig. 5-7: Standard accessories and ordering designations for 6.3005.XXX Exchange Units

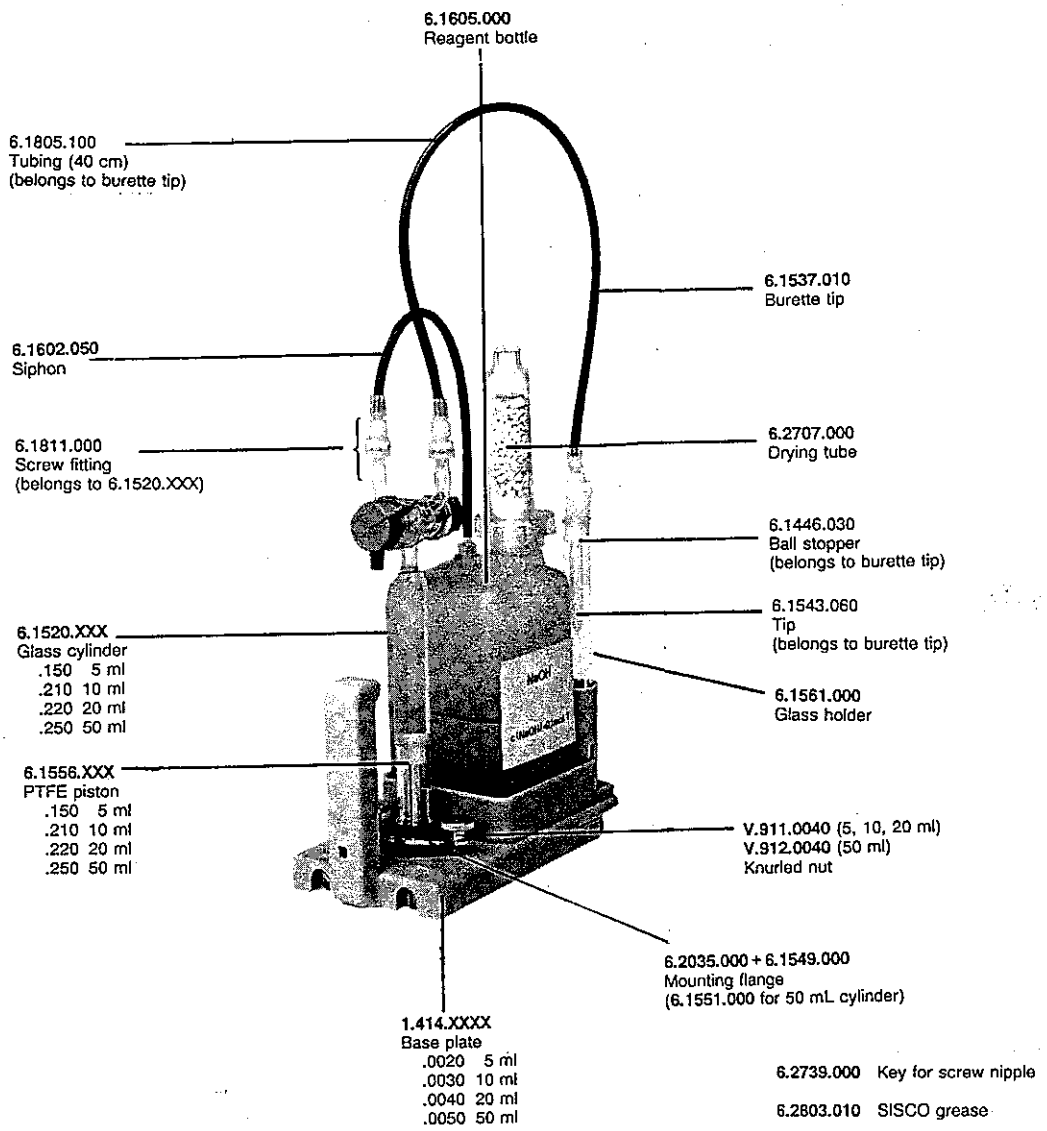


Fig. 5-8: Standard accessories and ordering designations for 6.3004.XXX Exchange Units

5.8.3 Micro-model – 1ml, 6.3006.113

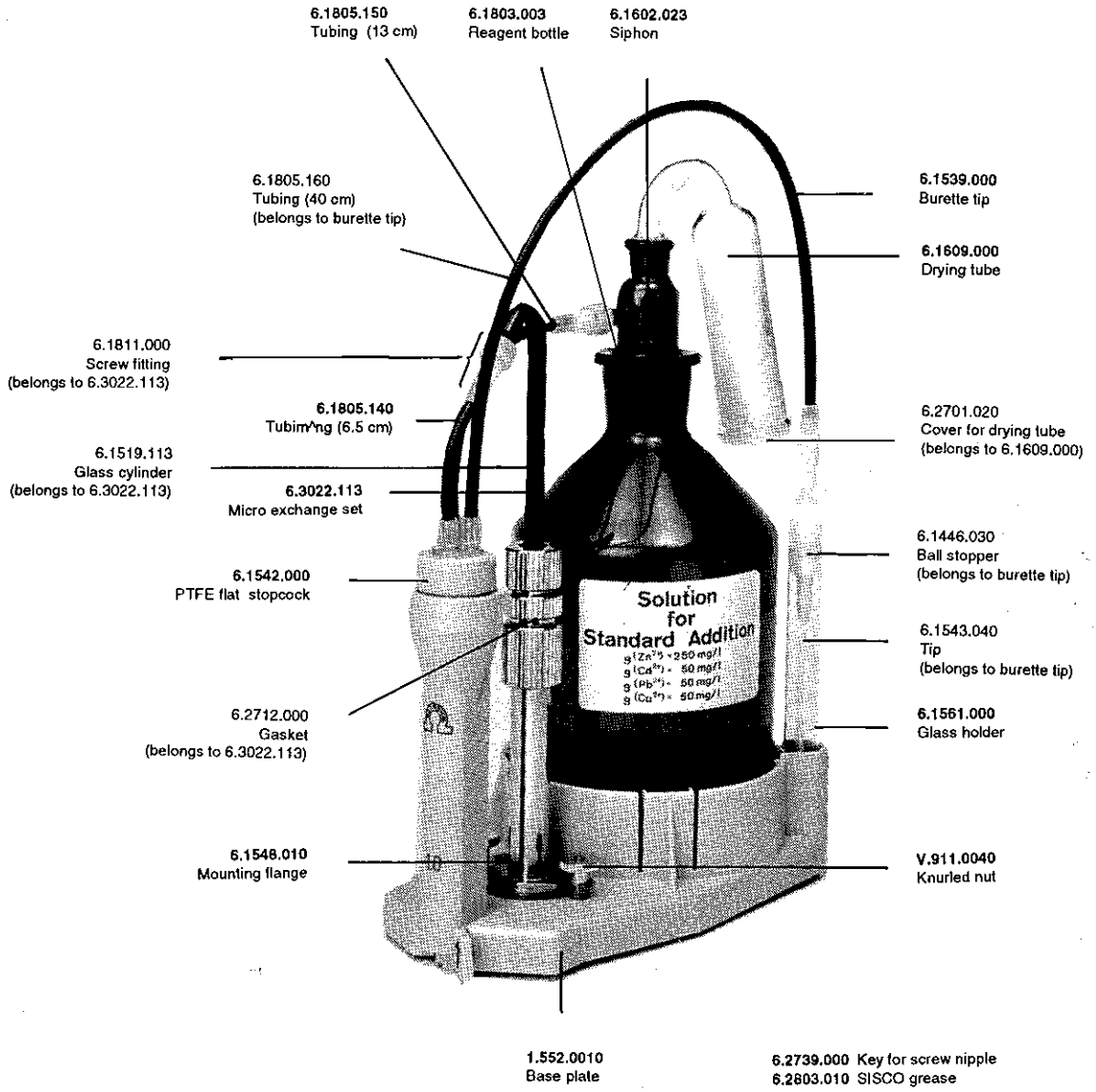


Fig. 5-9: Standard accessories and ordering designations for 6.3006.113 Exchange Unit

5.8.4 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:

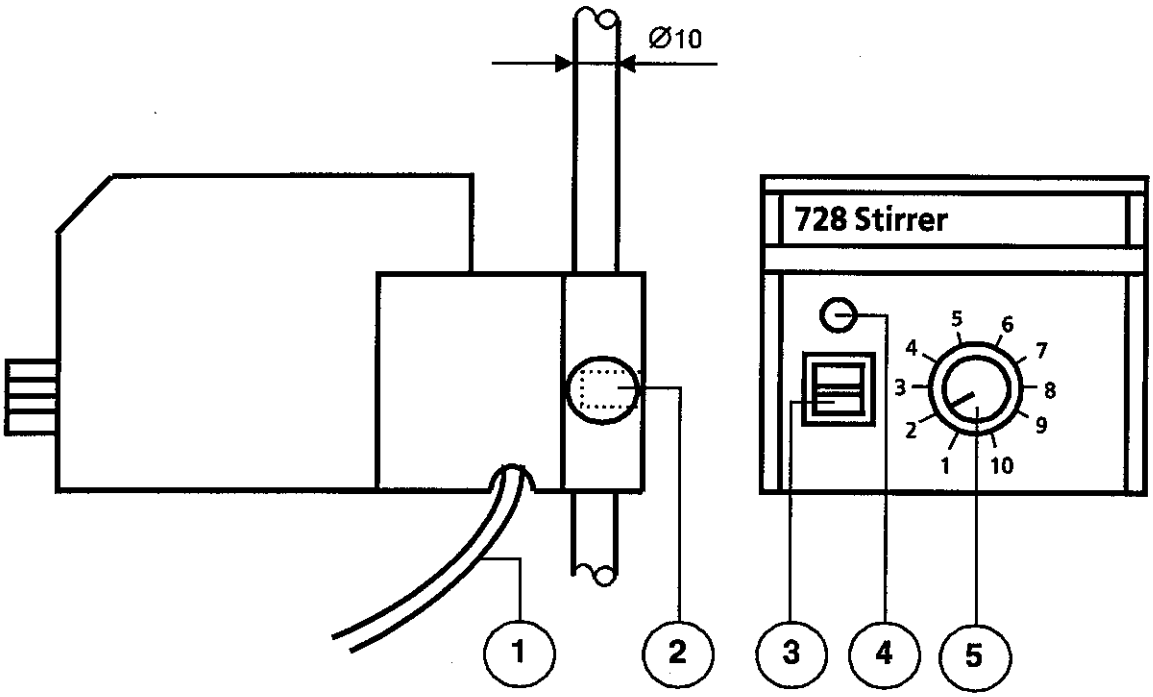
Earthing for burette tip	6.1808.030
Tip without anti-diffusion valve	6.1543.060
Tip with anti-diffusion valve	6.1543.050

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

6. Appendix

6.1. 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

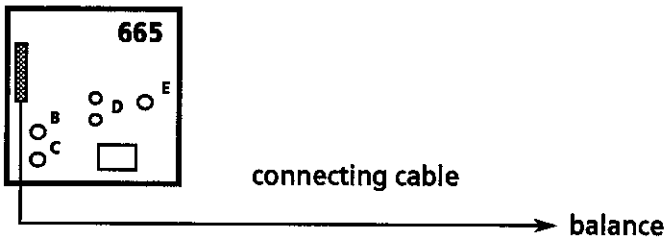
	Length	Dimensions	Shape
6.1903.000	8 mm	Ø = 4 mm	O
6.1903.010	12 mm	Ø = 4 mm	O
6.1903.020	16 mm	Ø = 4 mm	O
6.1903.030	25 mm	Ø = 5 mm	O
6.1906.000	42 mm	-	Δ
6.1906.010	25 mm	-	Δ
6.1906.020	26 mm	-	oval

6.2 Balance connection

The following types of balance can be connected to the 665 Dosimat:

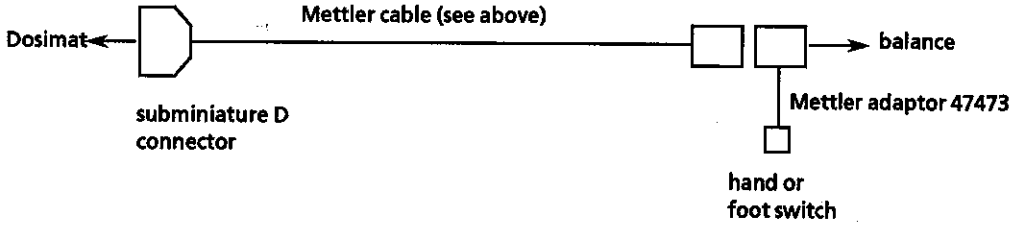
Sartorius with interface MP8-1 or MP8-4
Mettler with interface 011, 016 or PM balances

The connection 665 Dosimat – balance is made as follows:



Connecting cables:

Sartorius, interface MP 8 – 1 3.980.3380
Sartorius, interface MP 8 – 4 3.980.3380
Mettler, interface 011 3.980.3370
Mettler, interface 016: Cable from Mettler, ordering No. ME 47 927: brown lead to pin 22 and white lead to pin 5 of the subminiature D connector (see figure below).
Mettler, PM-balance: Cable from Mettler, ordering No. 33 852: brown lead to pin 22, green lead to pin 25 and white lead to pin 5 of the subminiature D connector (see figure below; balance not in mode "send continuous", "dynamic", or "animal weighing").



Note:
- Select the correct balance on the Dosimat (special key 5).
- Select the baud rate of the Dosimat such that it corresponds with that of the balance (special key 1).

Weighings can be transferred to parameter "s" of the Dosimat with the aid of a transfer key on the balance:

- In DOS mode with display /s = /
- In CNT D mode with display /s g/ (substance size).

If another instrument is to be connected to socket A of the Dosimat in addition to the balance, the 6.2125.000 double plug is available.

6.3 Continuous dosing with two Dosimats

Two 665 Dosimats are suitable for continuous dosing.

The two 665 Dosimats are connected with the 3.980.3140 cable:

3.980.3140 cable

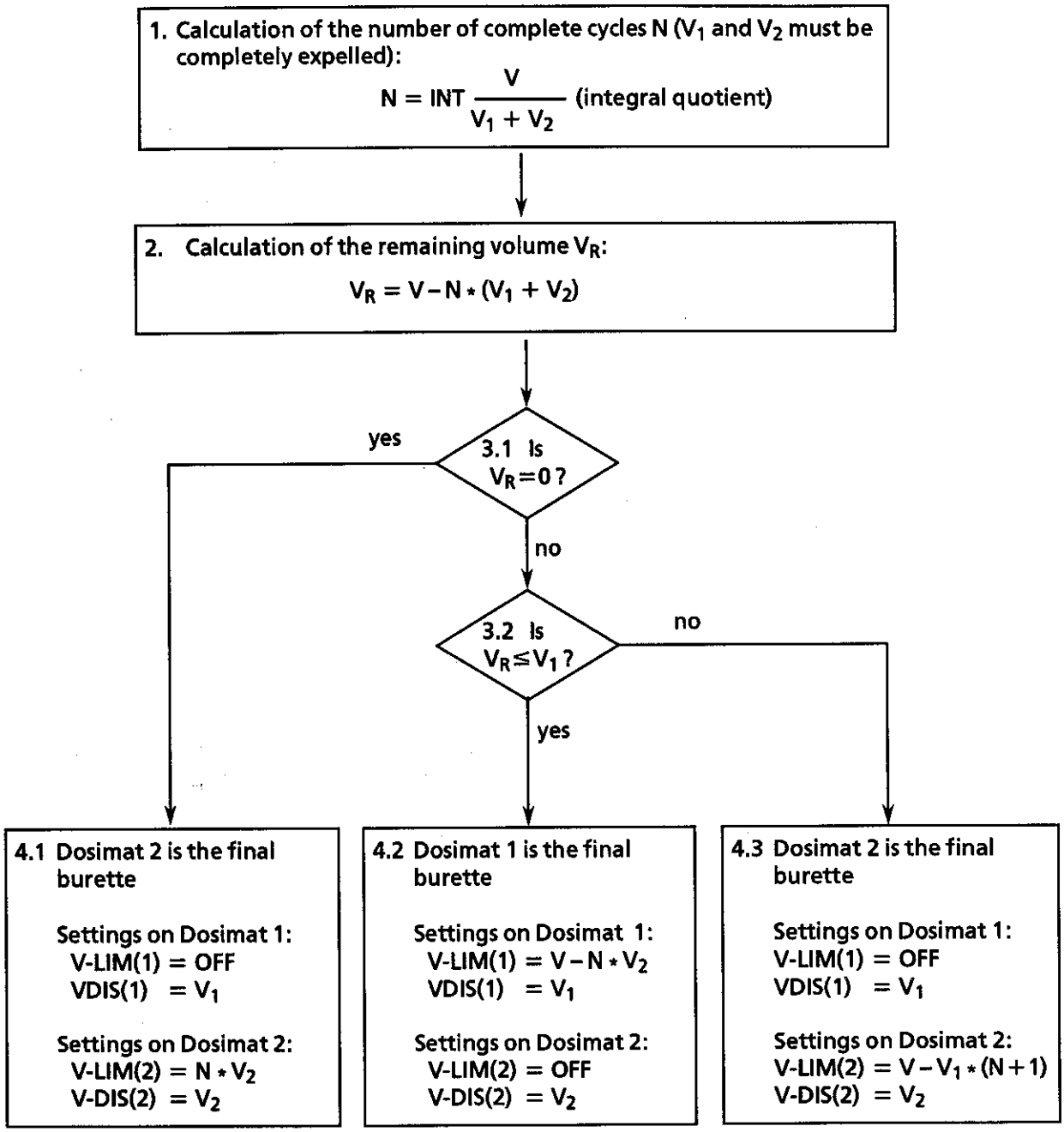
The DIS C mode is selected for both Dosimats and the dispensing volume set equal to the volume of the exchange unit mounted (V-DIS = $V_{burette}$). If one of the Dosimats is started and reaches the preselected dispensing volume, this triggers the start of the other, etc.

Prerequisite for continuous dosing is that the expelling rate "rate ↑" is set ≤ 0.85 "rate $\downarrow_{max}$" of the smaller of the two exchange units, i.e.

1 ml EU	≤	2.55 ml/min
5 ml EU	≤	12.75 ml/min
10 ml EU	≤	25.50 ml/min
20 ml EU	≤	51.00 ml/min
50 ml EU	≤	127.50 ml/min

At high rates, the effective expelling rate can deviate from the set rate by max. 4 % as a result of the finite resolution of the digital rate control, but the effective rate is held constant with quartz crystal accuracy.
The maximum filling rate "rate ↓" should be used.

If dosing to a fixed end volume V is envisaged, V-LIM is set according to the following rules:



Key:

V: end volume
V_1: cylinder volume on Dosimat 1 (start Dosimat)
V_2: cylinder volume on Dosimat 2

Example: *Continuous dosing of 55 ml. Two exchange units with the cylinder volumes $V_1 = 20$ ml and $V_2 = 10$ ml are available.*

Key:

End volume	$V = 55$ ml
Volume of the EU of the start Dosimat	$V_1 = 20$ ml
Volume of the EU of the 2nd Dosimat	$V_2 = 10$ ml

1. $N = INT\left(\frac{55}{20 + 10}\right) = 1$
2. $V_R = 55\ ml - 1 * (20\ ml + 10\ ml) = 25\ ml$
3. *V_R is not zero. Is 25 ml less than 20 ml? No, i.e. point 4.3 of the above scheme is applicable:*

4.3 V-LIM of the 2nd Dosimat:
$V\text{-}LIM = 55\ ml - 20\ ml * (1 + 1) = 15\ ml$

Settings

Dosimat 1 (start Dosimat):		*Dosimat 2:*	
20 ml exchange unit		*10 ml exchange unit*	
V-DIS	= 20 ml	*V-DIS*	= 10 ml
V-LIM	= OFF	*V-LIM*	= 15 ml
rate ↑	≤ 25.50 ml/min	*rate ↑*	≤ 25.50 ml/min
rate ↓	= 60 ml/min (max)	*rate ↓*	= 30 ml/min (max)

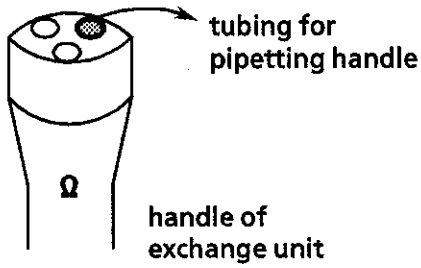
6.4 The 6.5611.000 Pipetting Equipment

The 6.5611.000 pipetting equipment comprises the following parts:

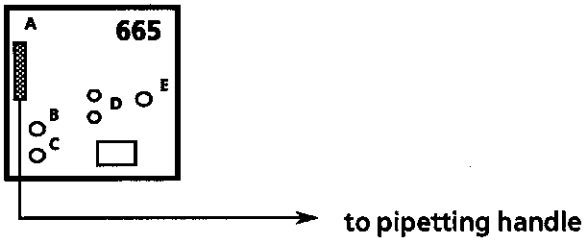
1	Handle with 6.1562.020 pipetting tubing (3 ml, FEP*)	6.1562.000
1	Pipetting tubing (0.7 ml, FEP*)	6.1562.010
1	Pipetting tip (PP) for 6.1562.010 pipetting tubing, pack of ten	6.1562.030

*FEP: fluorinated polyethylene/propylene

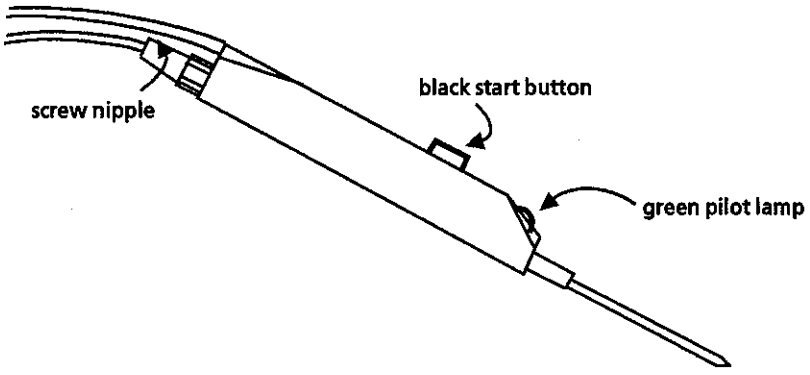
The tubing of the pipetting handle is attached to the exchange unit in place of the burette tip.



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



When the green pilot lamp is on, the Dosimat is ready and 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.



<u>Important:</u> The pipetting tubing must always be clean and free from kinks!

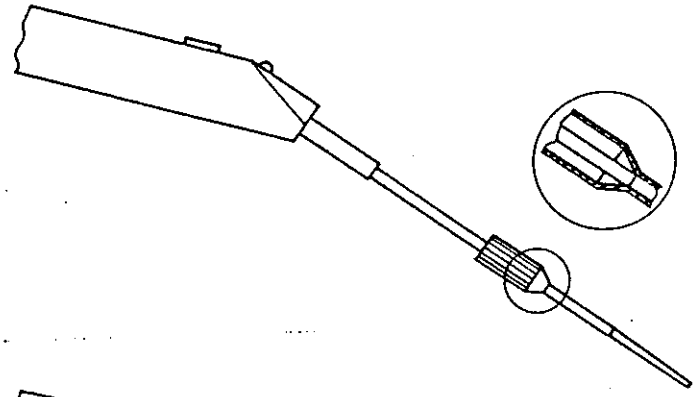
Changing the 6.1562.020 tubing (3 ml)

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.

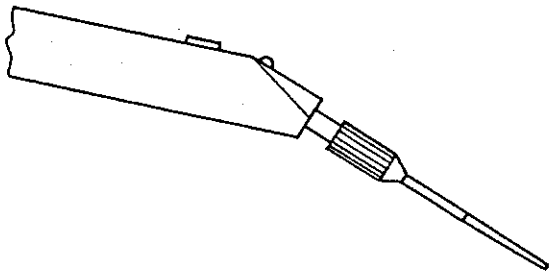
Using the 6.1562.010 tubing (0.7 ml)

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.



6.5 Technical data

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 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 665 Dosimat
Extended functions	with additional 6.2124.000 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

Data outputs

digital	Data transfer interface according to RS 232 C
analogue	
Representation	Volume as voltage signal: 0 ... 1000 mV = 1, 2 ... 10 burette cylinder volumes (selectable)
Resolution	1 mV

Remote control

Data transfer interface according to RS 232 C;
all modes and parameters are accessible to remote control.

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	Designed and tested in accordance to 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 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 6.3006.XXX or 6.3007.XXX exchange unit	
width	150 mm
height	450 mm
depth	275 mm
Titrating stand with 6.3006.XXX or 6.3007.XXX exchange unit	
width	240 mm
height	450 mm
depth	275 mm
Weight	
Dosimat with 6.3006.XXX or 6.3007.XXX exchange unit	app. 4 kg
Titrating stand with 6.3006.XXX or 6.3007.XXX exchange unit	app. 5.2 kg

6.6 Guarantee

Under the METROHM guarantee, all faults which can be proved to be due to material, constructions or manufacturing defects occurring within 12 months of the day of delivery will be repaired free of charge in our works. Only freight charges will be invoiced to the customer.

Inspection work not necessitated by material or manufacturing defects will be charged for, even during the guarantee period. For components of outside manufacture, in so far as these form major part of the apparaturs, the guarantee conditions of outside manufacturer will be held valid.

For performance and accuracy guarantees, the specifications given in these Instructions for Use will be held binding.

If damage to a package is visible on delivery, or if transport damage is observed when the goods are unpacked, the suppliers should be informed at once and a written statement should be made out. In the absence of an official damage report we cannot be legally responsible for the cost of replacements.

When returning apparatus and accessories for servicing, etc., the original packaging material should be used as far as possible. Before being embedded in shavings or similar material, parts should be wrapped so as to protect them against dust (for instruments and apparatus units a plastic bag is indispensible). The guarantee does not cover damage due to unsuitable or careless packaging.

6.7 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.

6.7.1 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.

6.7.2 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 6.7.3.4).

6.7.3 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.

6.7.3.1 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}.

6.7.3.2 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.

6.7.3.3 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)

6.7.3.4 Example for a 10 mL Exchange Unit

Temperature	23.5 °C		
Atmospheric pressure	696 mm Hg	*Regression data*	
		Slope	1.00104
Dispensed liquid	Boiled dist. water	Intercept	0.0016 mL = 1.6 µL
Density (from table)	0.9977417 g/mL	Correlation coefficient	0.999999945
Calculation factor	1.0036527		

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

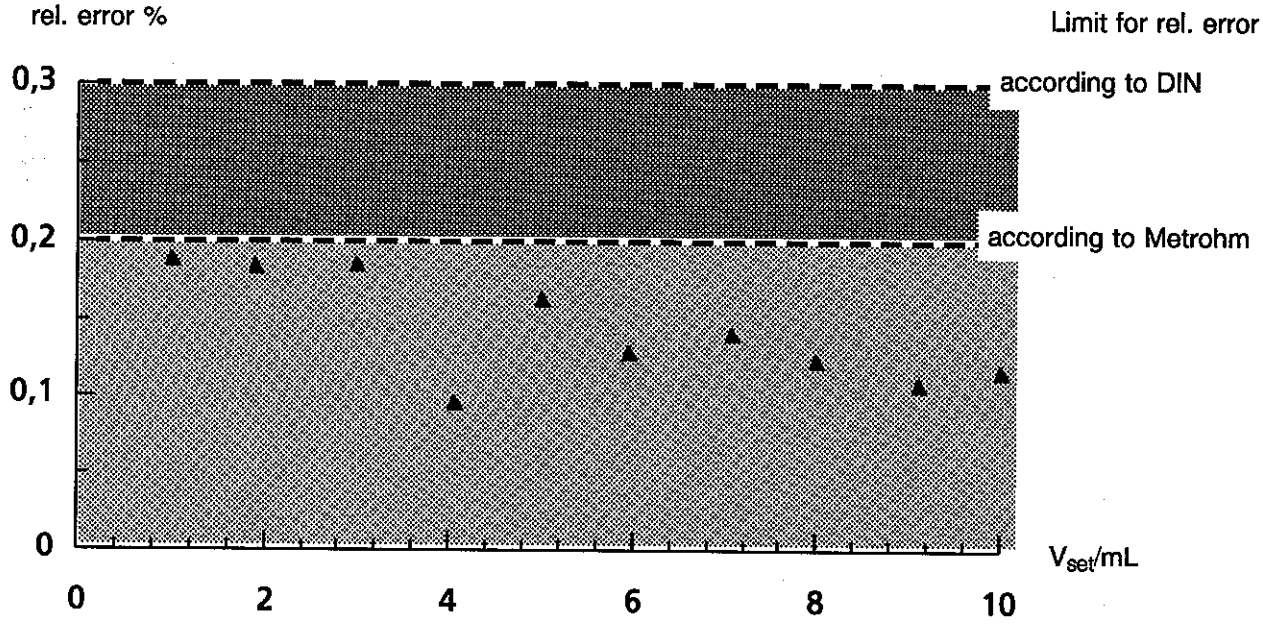
Calculation of the calculation factor and the first V_{actual} using formula 1):

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

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}:



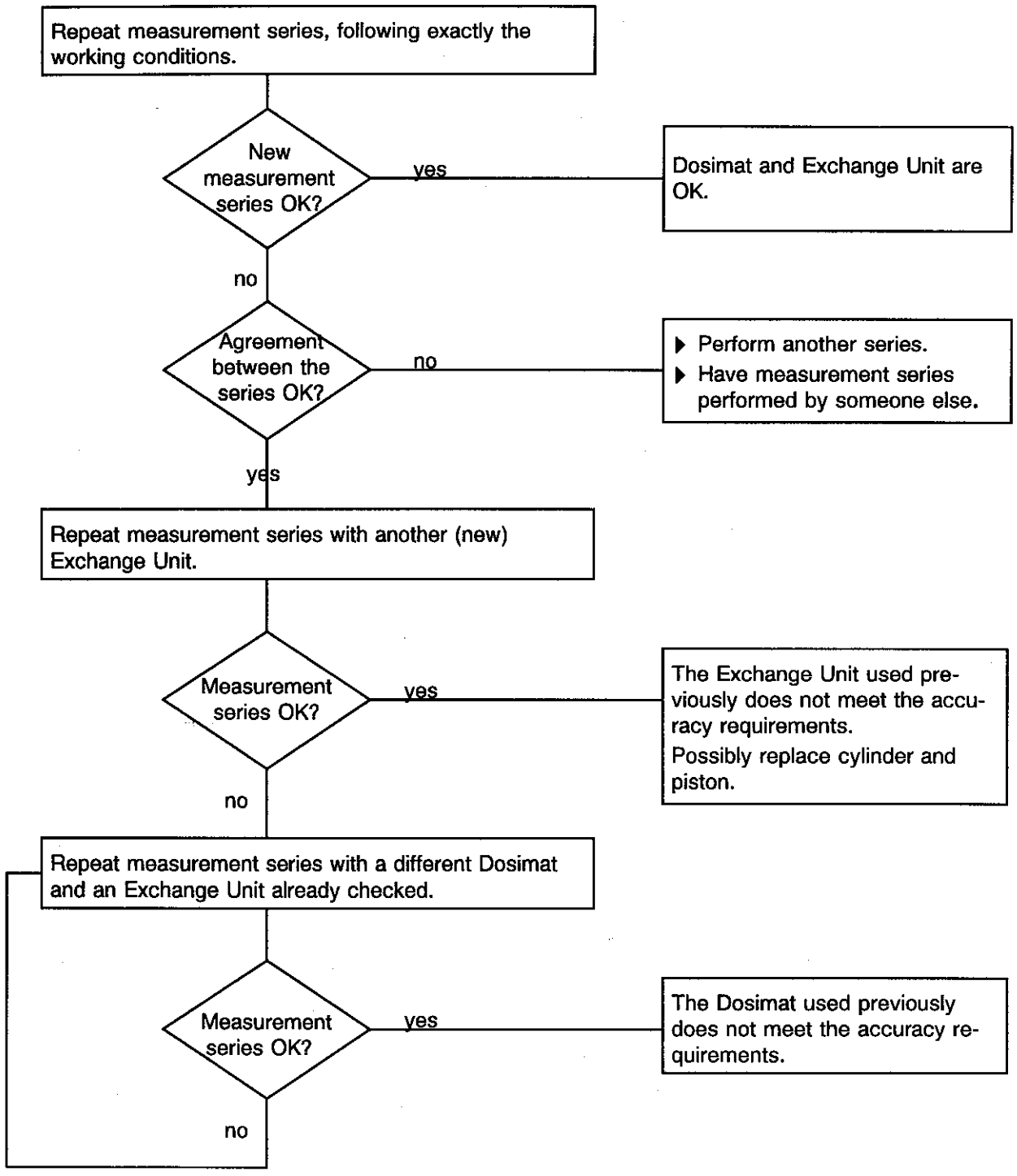
If you recalculate the example, the results of the linear regression may be slightly different from the values above due to different internal arithmetic resolutions on different calculators.

6.7.3.5 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).

6.7.4 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 .....

6.8 Scope of delivery and ordering designations

665 Dosimat including the following accessories:	**2.665.0010**
1 x Cable with feed push-button, length: 1 m	6.2107.000
1 x Card for managing the user memory	6.2242.000
1 x Key for Exchange Units	6.2739.010
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	8.665.1023
665 Dosimat as 2.665.0010, but: with built-in analogue output	**2.665.0020**
665 Dosimat, as titrating stand including the following parts:	**2.665.0030**
1 x 665 Dosimat, without accessories	1.665.0010
1 x Magnetic Stirrer without accessories	1.728.0010
1 x Base plate with stand rod	6.2001.010
1 x Cable with feed push-button, length: 1 m	6.2107.000
1 x Stirring bar16 mm	6.1903.020
1 x Stirring bar 25 mm	6.1903.030
1 x Electrode holder	6.2021.020
1 x Clamping ring for electrode holder	6.2013.010
1 x Card for managing the user memory	6.2242.000
1 x Key for Exchange Units	6.2739.010
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 Plastic dust cover	6.2723.130
1 x Operating instructions	8.665.1023
665 Dosimat, as titrating stand as 2.665.0030, but: with built-in analogue output	**2.665.0040**

Options

In order to profitate from all the possibilities of the 665 Dosimat, a separate operating unit is necessary. This operating unit is not included in the scope of delivery of the 665 Dosimat and has to be ordered separately:

Miscellaneous

Keyboard (operating unit) for 665 Dosimat	6.2124.000
Pipetting equipment, see page 82	6.5611.000
Double plug for socket A of 665 Dosimat	6.2125.000
Recorder (Recording time/volume curves), Dosimat with analogue output	3.980.3170
PC program for 665 Dosimat control	6.6001.010
2nd 665 Dosimat	3.980.3140
646 VA-Processor	6.2124.010

Stirrer, Ti Stand, pH-Meter

728 Magnetic Stirrer	2.728.0040
722 Rod Stirrerr	2.722.0010
703 Ti-Stand with Magnetic Stirrer and automatic aspiration	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 692 pH-Meter and Stirrer – 665 Dosimat	6.2138.010

Cable for connection to Titrators

702, 716 Titrinos, Activate Puls	6.2139.000
670 Titroprocessor	6.2124.010
682 or 686 Titroprocessor with 1 665 Dosimat	3.980.3090
682 or 686 Titroprocessor with 2 665 Dosimats	3.980.3100
536 or 576 Potentiograph	3.980.3060
614 Impulsomat	3.980.3250
614 Impulsomat, Recorder (Combi Titrator), Dosimat with analogue output	3.980.3120
614 Impulsomat and Labograph 586 (Combi-Titrator), Dosimat with analog. output	3.980.3200
614 Impulsomat and 657 or 664 Control Unit (of Sample Changer)	3.980.3150
633 KF Titrator	6.2115.020
526 Endpoint Titrator	3.980.3260
Double plug for socket A of 665 Dosimat	6.2125.000

Cable for connection to Exchange Unit

657 or 664 Control Unit (of Sample Changer)	3.980.3130
657 or 664 Control Unit (of Sample Changer), 614 Impulsomat	3.980.3150
702, 716 Titrinos, Actrivate Puls and 664 Control Unit of Sample Changer	3.980.3610
692 pH-Meter and 664 Control Unit (of Sample Changer) for ADD	3.980.3620
Double plug for socket A of 665 Dosimat	6.2125.000

Cable for connection to Printer, Calculator

Printer Epson P40, P 80	6.2124.040
Printer Seiko DPU 411	6.2124.060
Printer Citizen iDP 560 RS	6.2124.070
Printer HP Think Jet	6.2124.070
Printer Epson with Interface #8148	6.2124.070
IBM-PC – 665 Dosimat	6.2124.050
PC program for 665 Dosimat control	6.6001.010
Double plug for socket A of 665 Dosimat	6.2125.000

Cable for connection to Balance

Sartorius Balance MP8	3.980.3380
Mettler Balance, Interface 011	3.980.3370
Mettler Balance, Interface 016, balance PM	Cable from Mettler, see page 78
Double plug for socket A of 665 Dosimat	6.2125.00

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

Ionenanalytik • Analyse des ions • Ion analysis • Análisis iónico
665 Dosimat

CE

Metrohm

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EC Declaration of Conformity

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

665 Dosimat

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

Source of the specifications:

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

Description of the instrument:

Universal dispenser for liquid handling in laboratories, for titration and dosing tasks.

Herisau, December 5, 1995

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