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765 Dosimat

Instructions for Use

8.765.1023

2005.06 ti/dm

Content

Explanation of symbols:

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

`DOS.....0.000 ml` means "display"

1 Overview

Front view of instrument:

1 Exchange unit
Normally the models with automatic cock changeover.
Note:
Choose the volume of the exchange unit in such a way that a volume between 10...100% of the nominal volume is expelled.

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`	The piston is moving upwards.
`DOS ↓ 3.456 ml`	The piston is moving downwards.
`DOS → 3.456 ml`	The cock is turned to the right.
`DOS ← 3.456 ml`	The cock is turned to the left.

The display of the status ↑ resp.↓ are specially important for very slow dosings where movements of the piston cannot 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 with Dosimat in stand-by position.
<GO>	Order to execute the current mode. With mode DOS, dosing goes on as long as <GO> is pressed.

4 Setting of display contrast

5 Analogue setting of dosing rate
Position 1 = lowest rate
Position 10 = highest rate
The expelling and filling rates can be set separately (see page 6).

Rear view of instrument:

6 **Data inputs and outputs**
Via data transfer interface according to RS 232 C including optional analogue output. For 25-pin D subminiature plug.
Important: Note plug positions, page 47!
Plug cables in and out only if the instruments are switched off.

7 **Data inputs and outputs**
Via data transfer interface according to RS 232 C. For 8-pin plug.
(For details see page 47)
Plug cables in and out only if the instruments are switched off.

8 **Connection for keyboard**
For details of operation with keyboard 6.2149.000 see page 4ff.

9 **Power connection**
In power supply systems, in which strong HF interferences (transients) are superimposed on the power voltage, the 765 Dosimat should be connected via an additional power line filter, e.g. METROHM 615 model.
The main cables supplied with the instrument are three-core and equipped with a plug with an earthing pin. If a different plug has to be fitted, the yellow/green lead must be connected to the protective earth. Each break in the earthing inside or outside the instrument can make it a hazard.
When the instrument is opened or if parts of it are removed, certain components may be live if the instrument is connected to the power line. The power cable must therefore always be unplugged when certain adjustments are made or parts replaced.

10 **Power switch**
Switching on and off Dosimat. The 765 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 765 Dosimat must be grounded correctly and effectively, if necessary through the separate earthing socket.

12 **Connection for stirrer**
In general 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* # 200 mA).

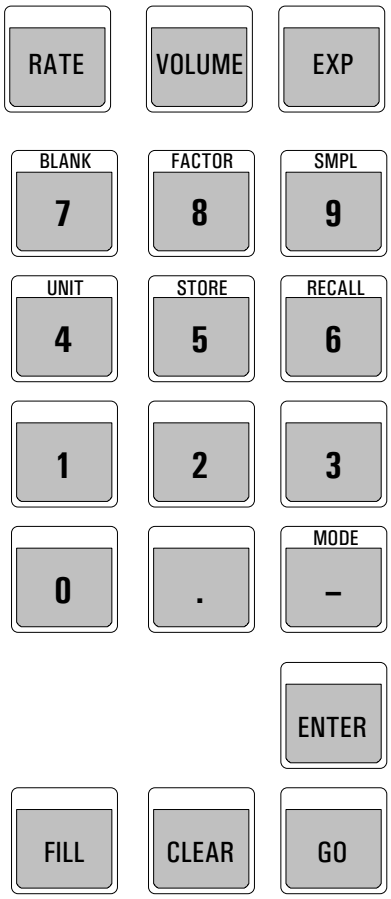
13 **Connection for external dosing contact**
E.g. 6.2107.000 push button cable.

14 **Indication of power voltage**
Make sure the current has been adapted correctly before Dosimat is switched on.

15 **Identification plate**
Indication of model, series and serial number.

2 Operation with the keyboard

2.1 Keypad



6.2149.000

RATE Expelling and filling rate in all modes.

VOLUME Different volumes depending on selected mode.

EXP Exponent.

BLANK, FACTOR, SMPL Calculation parameters in mode DOS.

UNIT Unit in modes DOS and CNT

STORE, RECALL Management of user memory: Storing, loading of modes.

MODE Selection of mode.

ENTER Confirmation of entries.

FILL Filling and emergency stop key.

CLEAR Resetting of the volume display to 0 with Dosimat in stand-by position.

GO Start mode. With mode DOS, dosing goes on as long as <GO> is pressed.

The keys <FILL>, <CLEAR>, <GO> are identical with the corresponding keys on Dosimat.

Rules for data input:

- On entering a negative number, key in minus sign first; <-> is not a "change of sign" key!
- Changeover between first functions (blank, factor etc.) and digits is done automatically.
- Terminate parameter entries with <ENTER>.
- Some keys are organized as *inquiry drums*, i.e. pressing these keys several times, display shows new inquiries. A new value is stored or a new feature is selected with <ENTER>. The program then returns to the initial state, the inquiry drum is left. Entering an inquiry drum, that inquiry, where the drum has been left last time, is displayed first.
- The Dosimat works with a resolution of 10'000 pulses per burette cylinder volume.

Exchange unit	**Resolution of display** Volume/mL	Rate mL/min	**Smallest increment** V
1 mL	.001	.001	0.1 µL
5 mL	.001	.005	0.5 µL
10 mL	.001	.010	1 µL
20 mL	.002	.020	2 µL
50 mL	.005	.050	5 µL

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. The smallest possible increments for 1 and 5 mL cylinders are not displayed. However, they are dosed and the display is rounded.

- Key <CLEAR> sets parameters to "OFF".

2.1.1 Key <RATE>

The inquiries of this key are identical for all modes.

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

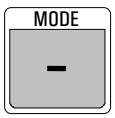
↑ `ml/min` Expelling rate
Range for digital setting depending on volume of exchange unit:

1 mL	0.001	3.00	mL/min
5 mL	0.005	15.0	mL/min
10 mL	0.010	30.0	mL/min
20 mL	0.020	60.0	mL/min
50 mL	0.050	150.0	mL/min

Key <CLEAR> sets "OFF", i.e.. the rate can be controlled analogically by means of potentiometer at the Dosimat 765.
If the preset rate is too high to be dosed with the exchange unit presently mounted, the rate is set automatically to its maximum.

↓ `ml/min` Filling or aspirating rate
The data input rules are the same as for the expelling rate.
The filling rate is set to maximum on changing the exchange unit (e.g. always after `no exch. unit!` *is displayed!).*

2.2 Modes



The modes are selected by the inquiry drum <MODE> and confirmed with <ENTER>.

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

DIS R: **DIS**pensing, **R**epetitive
Dosimat is dosing a stored dispensing volume if <GO> is pressed, the burette cylinder is refilled and display reset to 0.000 mL.

DIS C: **DIS**pensing, **C**umulative
Dosimat is dosing a stored dispensing volume if <GO> is pressed, the dispensed volume (V-DIS) remains displayed.

PIP: **PIP**etting
Aspirating and subsequent expelling of a stored pipetting volume.

DIL: **DIL**uting
Aspirating a stored pipetting volume and subsequent expelling of the pipetting and diluting volume.

CNT D: **C**o**NT**ent **D**ispenser
Preparation of solutions with preselected content.

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> repeatedly until display shows `DIS C` .

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

Display shows `DIS C 0.000 ml`.

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

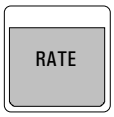
All modes which are loaded into the working memory by key <MODE> are equipped with a set of standard parameters:

Mode	V-DIS/V-PIP mL	V-LIM/V-DIL mL	Rate ↑ mL/min	Rate ↓ 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

Dosimat is dosing as long as <GO> is pressed. Result calculation can be activated.

`V-LIM OFF ml` Security volume:
Dosing is stopped if V-LIM has been reached.
Input range: 0.001...999.999 mL, OFF



Expelling and filling rate, see page 6.

Calculation values

`b = 0. ml` Blank value
Input range: 0...±999.999 mL

`f = 1.` Factor
Input range: 0... ±1E33

`s = 1.` Sample size
Input range: 0... ±1E33
Input manually or on-line with balance, see page 56

`unit` Unit
Input range: ppm, %, g, mg, g/L, mg/L, mol, mol/L, mL, L, /pc, none

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 each entry of a calculation value (blank, factor, smpl). Pressing <CLEAR> display shows the dosed volume in mL. To start a new dosing, press <GO> twice, pressing once resets the volume in display to 0.000 mL.

Printing the result on a printer

If Dosimat is set to `send RS 232 on` (special settings see page 18), filling the Dosimat or re-calculation triggers a print command. A continuous number (#), the dosed volume and the calculated result are printed.
Do set new calculation parameters for the **next** dosing only after having pressed <GO> once, i.e. if display shows `DOS 0.000 ml`.
The continuous number is set to zero on switching on the Dosimat and incremented by 1 on every filling command.

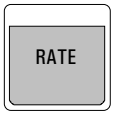
Example of print-out

```
#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 %
```

2.2.2 Mode DIS R, Repetitive Dispensing

Dosimat is dosing a stored dispensing volume if <GO> is pressed. The burette cylinder is refilled and display reset to 0.000 mL.

V-DIS 1. ml Dispensing volume
Input range: 0.001...999.999 mL



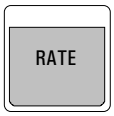
Expelling and filling rate, see page 6.

2.2.3 Mode DIS C, Cumulative Dispensing

Dosimat is dosing a stored dispensing volume if <GO> is pressed, and the dispensed volume (V–DIS) remains displayed.

V-DIS 0.1 ml Dispensing volume
Input range: 0.001...999.999 mL

V-LIM OFF ml Security volume
Dispensing is stopped, if V-LIM has been reached.
Input range: 0.001...999.999 mL, OFF



Expelling and filling rate, see page 6.

Tandem Dosing
Mode DIS C is suitable for continuous dosing with 2 Dosimats, see page 57.

2.2.4 Mode PIP, Pipetting

Aspirating and subsequent expelling of a stored pipetting volume.

VOLUME

`V-PIP 0.1 ml` Pipetting volume
Input range depends on the volume of the exchange unit:

1 mL	0.001...	0.900 mL
5 mL	0.001...	4.900 mL
10 mL	0.001...	9.800 mL
20 mL	0.002...	19.700 mL
50 mL	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! The aspiration tube must contain V-PIP!

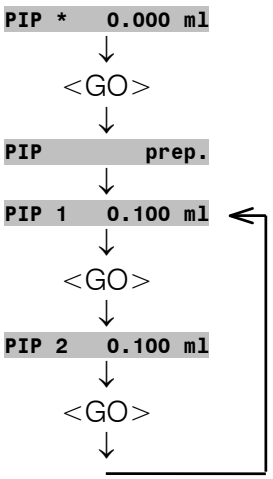
RATE

Expelling and filling rate see page 6.

If mode PIP is loaded, the display shows `PIP * 0.000 ml`.
The sign * in the display means that mode "PIP" is not yet ready to be used. With a first <GO>, a preparation step is carried out which is marked in the 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.

Sequence of PIP



Standard mode PIP.

Preparation step: Hold burette tip free at working height.
Ready to aspirate the pipetting volume: Immerse burette tip.

Ready to expel the pipetting volume: Hold burette tip for pipetting.

Note

- A new air bubble is built with every preparation step ("prep.") 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.
- For best pipetting results we recommend exchange units with volumes ≤ 20 mL and pipetting equipment 6.5611.000.
- 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

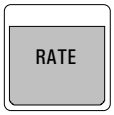
Aspirating a stored pipetting volume and subsequent expelling of the pipetting and diluting volume.

`V-PIP 0.1 ml` Pipetting volume
Input range depends on the volume of the exchange unit:

1 mL	0.001...	0.900 mL
5 mL	0.001...	4.900 mL
10 mL	0.001...	9.800 mL
20 mL	0.002...	19.700 mL
50 mL	0.005...	49.500 mL

`V-DIL 1. ml` Diluting volume
Input range: 0.001...999.999 mL

Note: The diluting liquid is unintentionally mixed with the pipetted liquid if it is aspirated into the burette cylinder! The aspiration tube must contain V-PIP!



Expelling and filling rate see page 6.

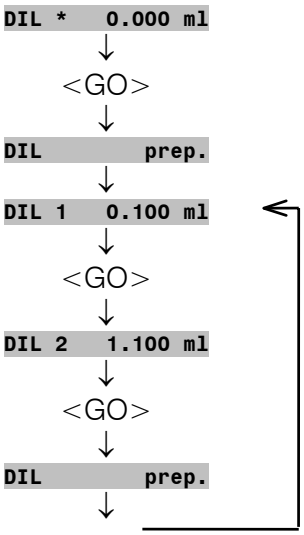
If mode DIL is loaded, the display shows `DIL * 0.000 ml`.

The sign * in the display tells you that mode DIL is not ready to be used. 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 1.100 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 <GO>. The preparation step is now carried out automatically and the Dosimat is ready to aspirate the next pipetting volume.

Sequence of DIL



Standard mode DIL.

Preparation step: Hold burette tip free at working height.
Ready to aspirate the pipetting volume: Immerse burette tip.

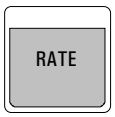
Ready to expel the pipetting and diluting volume: Hold burette tip for pipetting.

Notes

- If you wish to change V-PIP, it is best to change it during filling in the preparation step, i.e. 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 erroneous and should be discarded. Another possibility is to expel the air bubble in mode DOS and to start Mode DIL from the beginning. V-DIL can be changed at any time without a new preparation step.

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 765 Dosimat dispenses the amount of solvent calculated correspondingly.

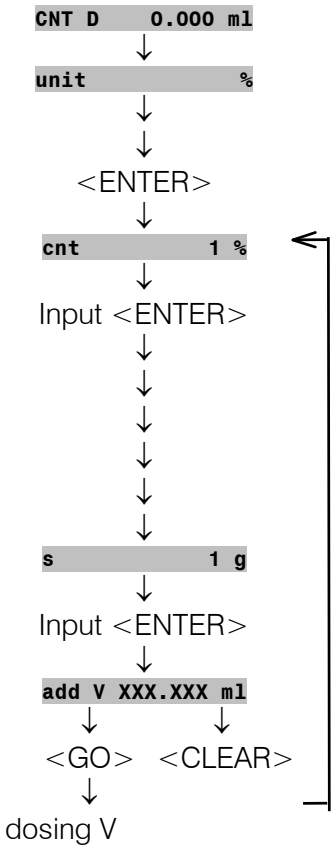


Expelling and filling rate see page 6.

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

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

Sequence of CNT D



Standard mode CNT D. Display changes automatically after preparation.
Choose unit by pressing key <UNIT>.
The volume is calculated according to the chosen unit.

Input of the desired numerical value for the content.
Depending on the unit selected the following auxiliary variables are inquired during the first run:

`M 1 g/mol`	Molar mass of the substance
`dens. 1 g/ml`	Density of the solvent
`f 1.00000`	Factor for volume contraction

Input of the weight manually or via a balance, see page 56.

The calculated volume is displayed and expelled with <GO>.
With <CLEAR> the values for "cnt" and/or "s" can be changed. This gives an idea of the approximate weighing.
Pressing <MODE>, the mode can be changed.

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	Formula for 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	$\frac{f \cdot s(10^6 - cnt)}{cnt\ dens}$
Molality	mol/kg	$\frac{s \cdot 10^3}{cnt \cdot M \cdot dens}$
	mmol/kg	$\frac{s \cdot 10^6}{cnt \cdot M \cdot dens}$

Application 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:

$$f = \frac{n*M(A)}{M(A_nB_m)} \quad \text{or} \quad f = \frac{m*M(B)}{M(A_nB_m)}$$

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

The following table shows factors for the most common ionic standards:

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

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

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.

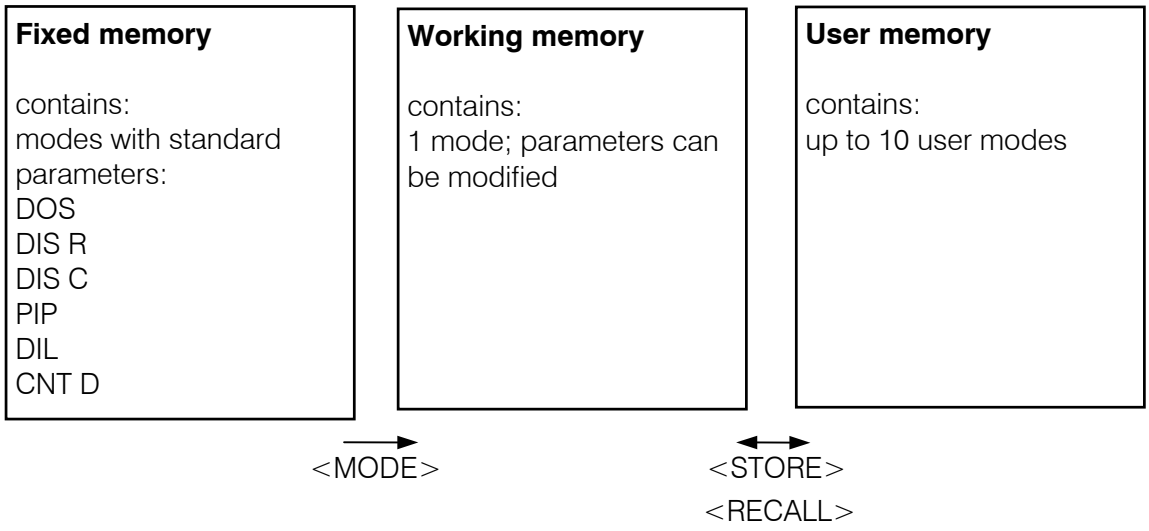
Several correction factors are shown in the following table:

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
$CuSO_4 5H_2O$/water	0.995	0.992	0.904

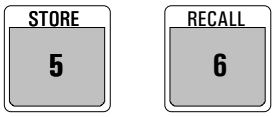
2.3 User memory

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 the following table:



Management of user memory



<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.

2.4 Special settings

Special settings can be executed by pressing keys <0> and <—> simultaneously. The display shows `Sys. Soft-Reset` . Press key <0> and keep it pressed until `special key 0..6` appears in the display.

Press key 1...6. Pressing key <CLEAR> once, leads back to the blinking display `special key 0..6` and pressing key <CLEAR> again leads to the corresponding mode in the working memory.

Pressing key <GO>, the next inquiry is displayed, with <ENTER> the setting is stored.

Key	Display	Explanation
< 0 >	`5.765.0010`	Display of program number
< 1 >	`baud rate 9.6 K`	Setting of baud-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 ΔU = 1000 mV at the analogue output: 1,2...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 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 detailed information about the connection of a balance see page 56.
< 6 >	`RS232 HSHK full`	Choice of handshakes for data transfer to RS232: full, none. "full" is used for connections with Metrohm instruments. "none" can be used e.g. for data transfer via a Windows terminal. See also page 45.

3 Error messages, troubleshooting

blinking value — The value keyed in is out of the input range.

3.1 Special messages and error messages

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.
Remedy: Call Metrohm-Service

error 2 — RAM-check: Error in on-chip-RAM.
Remedy: Call Metrohm-Service

error 3 — RAM-check: Error in off-chip-RAM.
Remedy: Call Metrohm-Service

error 4 — RAM-check: Error in on- and off-Chip-RAM.
Remedy: Call Metrohm-Service

error 5 — Check sum error in off-chip-RAM.
Remedy: RAM has to be re-initialized: 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 program.

Note: Stored user modes will be cleared on re-initializing 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 or the calculated result is larger than the range of numbers which can be displayed (1 E+39).
Exit: <CLEAR>

NaN — (Not a number). In mode DOS, a result has been calculated with s=0 and f=0.
Exit: <CLEAR>

no exch. unit! — Exchange unit is not (properly) mounted.
Exit: Mount exchange unit properly.
Note: The filling rate is set to maximum.

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

V< XXXX ml — 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.

volume <resol.!

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.

V-LIM reached!

Security volume is reached.

Exit: <FILL>.

V-PIP > V(B)

The stored pipetting volume is higher than the burette volume of 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.

3.2 Diagnosis

3.2.1 General

The 765 Dosimat is a very precise and dependable feeding instrument. Thanks to its rugged construction, it is highly unlikely that external mechanical or electrical influences will have any adverse effect on its functions.

Although a fault in the instrument can not be excluded with certainty, the possibility is greater that malfunctions are caused by wrong operation or handling, through improper connections and the operation with third-party devices.

Whatever the case, it is always advisable to localise the fault with the diagnostic tests, which can be performed quickly and simply. The customer need call Metrohm service only when the instrument really has a fault. Further, he can use the results of the specific diagnostic function to provide the service engineer with much more precise information.

In the case of inquiries, always quote the serial number on model plate (see page 3), the program version (see page 18) and if applicable the error message.

Procedure

The diagnostic menu listed in section 3.2.2 shows all components for which detailed instructions (diagnostic steps) are available for checking the functionality.

In the case of a possible malfunction, we advise you to perform either the corresponding diagnostic step or all diagnostic steps as a routine check on the instrument.

The reactions of the Dosimat to the instructions must be compared with the descriptions in the diagnostic step. If the Dosimat do not show the expected reaction ("No" case), the appropriate diagnostic step must be repeated to exclude operating errors. However, it is highly probable that repeated wrong reactions indicate a malfunction.

Equipment required:

3.496.0070	Dummy-exchange unit (or exchange units if possible with different cylinder volumes).
6.2107.000	Push-button cable or ordinary test lead with 4 mm banana plugs
6.2149.000	Keyboard
3.496.8360	Test plug
-.---.----	Stop watch or watch with second hand.
-.---.----	Voltmeter (perhaps a calibrated recorder)

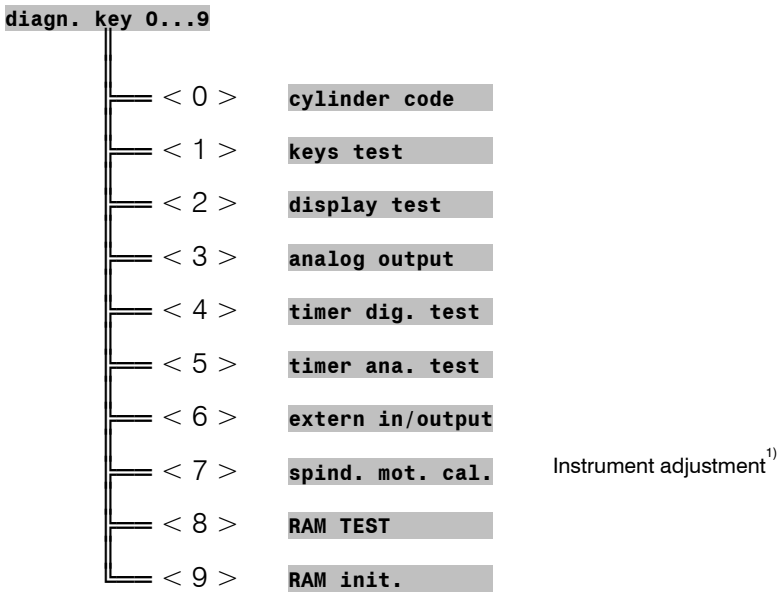
3.2.2 Summary

3.2.3 Prepare instruments for diagnostic tests

1. Power off.
2. Remove exchange unit.
3. Disconnect all cables at rear, except mains cable and keyboard.
4. Power on and simultaneously press key <9> and keep pressed until

   `diagn. key 0...9`

5. The individual inquiries of the several diagnostic steps are accessed using the key <0> ... <9>, exit is with the <CLEAR> key.



1) *This diagnostic step is reserved for the service engineer and therefore will not be described within this document.*

3.2.4 Diagnosis of cylinder code

1. Prepare instrument for diagnostic test (see chap. 3.2.3).

2. <0>

```
cylinder code
```

3. <GO>

```
no exch. unit!
```

4. Insert (dummy) exchange unit.

```
code:     xx ml
```

5. Check whether the displayed ml-Code (xx ml) corresponds to the exchange unit.

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

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

6. <CLEAR>

```
diagn. Key 0...9
```

3.2.5 Diagnosis of key board

1. Prepare instrument for diagnostic test (see chap. 3.2.3).

2. <1>

```
keys test }
```

3. <GO>

```
key: rate
```

The display requests to press the key <RATE> on the keyboard 6.2149.000.

4. <RATE>, <7>, <4>, <1> etc.

If the correct key was pressed and the test was positive the name of the next key to be pressed will be displayed.

Display E 10: and on the right-hand side the name of an other 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"

After pressing the last key (GO), the following appears:

```
keys       o.k.
```

5. <CLEAR>

```
diagn. key 0...9
```

3.2.6 Diagnosis of display

1. Prepare instrument for diagnostic test (see chap. 3.2.3).

2. <2>

```
display test
```

3. <GO>

Characters are generated for an optical check of the display:

1. *The display is written to from left to right with the character* ▮ .
2. *Repeatedly the display is written to with the characters* ⁞ *and* ⁞ .
3. *In quick succession the display is written to with the capital letters from the alphabet.*
4. *The display is written to with the character set (see Fig. 1) as continuous moving display.*

The test sequence can be held by pressing key <5> and restarted.

The continuous moving display is quit by pressing the keys <5> and <CLEAR>.

```
DP, keys test
```
for 1.5 s

```
key: FILL }
```

The display requests to press the key <FILL> on the front of the Dosimat.

4. <FILL>, <CLEAR>, <GO>

If the correct key was pressed and the test was positive the name of the next key to be pressed will be displayed.

Display E 10: and on the right-hand side the name of an other 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"

After pressing the last key (GO), the following appears:

```
keys       o.k.
```

5. <CLEAR>

```
diagn. key 0...9
```

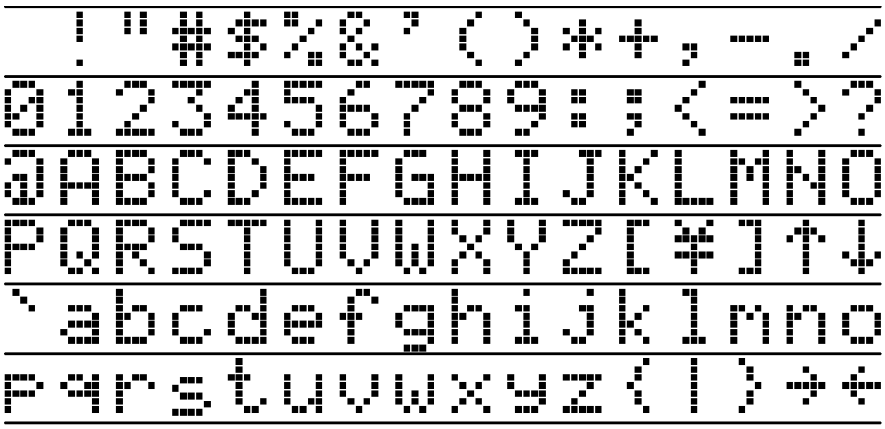


Fig. 1

3.2.7 Diagnosis analog output

To carry out this diagnosis step the optional analog output has to be fitted in the Dosimat (fitted as a standard with versions 2.765.0020, 2.765.0040)

1. Prepare instrument for diagnostic test (see chap. 3.2.3).

2. Connect voltmeter, DVM or recorder by means of cable 3.980.3170 to location A (do not switch off the unit).

Plug A Pin 21 (0...+1 V)
Plug A Pin 11 (ground)

3. <3>

```
analog output
```

4. <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. <GO>

```
V-out = 1.000 V
```

Measuring instrument reads +1.000 V (tolerance ±6 mV + tolerance of point 4.)

6. <GO>

```
V-ramp    1...2
```

In this test sequence the Dosimat produces at the analog output a triangle voltage. Two different rising or falling times can be selected:

1: rising or falling time = 48 ms (reserved for the service engineer)

2: rising or falling time = 40 s

7. <2>, <GO>

```
V-ramp = 40s ↑/↓
```

Within the first 40 s the voltage rises linear.

Within the second 40 s the voltage falls linear.

When terminated the display shows:

```
V-ramp = 1...2
```

8. <CLEAR>

```
diagn. key 0...9
```

9. Remove cable and measuring instrument.

3.2.8 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.

1. Prepare instrument for diagnostic test (see chap. 3.2.3).
2. <4>

   ```
   timer dig. test
   ```

3. <GO>

   ```
   timer dig.
   ```

   The frequency of the digital timer is measured during 1.5 s. If no fault is found, the following appears:

   ```
   timer dig.  o.k.
   ```

4. <CLEAR>

   ```
   diagn. key 0...9
   ```

3.2.9 Diagnosis of analog timer

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

1. Prepare instrument for diagnostic test (see chap. 3.2.3).
2. Turn knob 'dV/dt' fully to the right.
3. <5>

   ```
   timer ana. test
   ```

4. <GO>

   ```
   timer ana.
   ```

   The frequency of the analog timer is measured during 1.5 s. If no fault is found, the following appears:

   ```
   timer ana.  o.k.
   ```

5. <CLEAR>

   ```
   diagn. key 0...9
   ```

3.2.10 Diagnosis of external inputs, outputs

This test is necessary only if the 765 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.

1. Prepare instrument for diagnostic test (see chap. 3.2.3).
2. Without switching off the instrument, insert plug 3.496.8360 into location A. Take care of the direction of the plug. Red banana plug to red socket 'D'.
3. <6>

   ```
   extern in/output
   ```

4. <GO>

   The test runs automatically. If no fault is found, the following appears:

   ```
   ext. in/out o.k.
   ```

5. <CLEAR>

```
diagn. key 0...9
```

6. Remove test plug 3.496.8360.

3.2.11 RAM-test

1. Prepare instrument for diagnostic test (see chap. 3.2.3).

2. <8>

```
RAM test
```

3. <GO>

The test runs automatically. If no fault is found, the following appears:

```
RAM TEST  passed
```

4. <CLEAR>

```
diagn. key 0...9
```

3.2.12 Diagnosis of spindle zero and cock changeover

1. Power off.

2. Insert exchange unit.

3. Power on.

Dosimat fills.

4. Remove exchange unit.

5. To check the spindle zero.

The spindle must be 0.2 - 0.6 mm below the edge of the mounting plate (see Fig. 2).

The link piece of the cock coupling must be parallel to the side walls of the Dosimat (see Fig. 3).

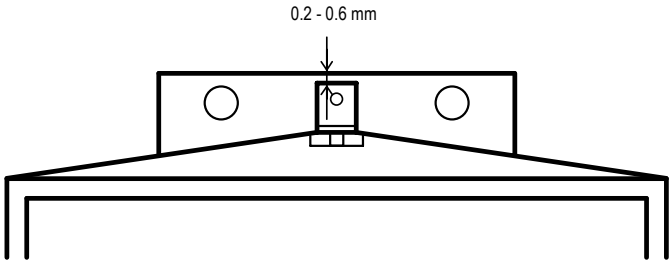


Fig. 2

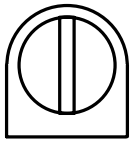


Fig. 3

3.2.13 Diagnosis of spindle drive

1. Insert exchange unit and put the burette tip into a collecting receptacle.

2. Connect push-button cable 6.2107.000 (if available).

3. Power off and wait for 5 s.

4. Power on and simultaneously press key <0> and keep pressed until:

```
special key 0..6
```

5. <3>

```
auto fill    ???
```

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

6. Press <GO> if auto fill 'on' otherwise go on with item 7.

```
auto fill    off
```

7. <ENTER>, <CLEAR>

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

Dosimat fills.

8. Actuate <MODE> several times until the display shows:

```
DOS
```

9. < ENTER >

```
DOS    0.000 ml
```

10. <RATE>

```
↑     OFF ml/min
```

11. < RATE >

```
↓      xx ml/min
```

xx : (depending on exchange unit code)

12. <CLEAR>

```
↓     OFF ml/min
```

13. < ENTER >

```
DOS    0.000 ml
```

14. Knob 'dV/dt' fully to the right.

15. 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.

```
cylinder empty!
```

Spindle remains at top position.

The running time of the spindle is 18 ... 22 s.

16. 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 spindle zero.

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

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

Filling time: *one cock cycle 1 s*
filling 18 ... 20 s

General rules:

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).

18. Knob 'dV/dt' fully to the left.

19. <MODE>: select DIS R.

20. <ENTER>

```
DIS R    0.000 ml
```

21. <VOLUME>

```
V-DIS       1. ml
```

22. 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

23. <ENTER>

24. <GO> (depress briefly) and with a stop watch take the time until the cock starts turning.

The time must be 14 ... 24 s.

25. Reset the parameter if under 5. the reading was auto fill = on .

3.3 RAM-initialisation

In rare cases, it is possible that major interference signals such as line spikes and lightning can have an adverse influence on the contents of the data memory. If the contents of the data memory are undefined, this is indicated after “power on“ with ‘error 5'. The keyboard is then blocked, no entering is possible until the RAM is initialised again.

1. Disconnect all cables at rear, except mains cable.
2. Power off and wait 5 s.
3. Power on and simultaneously press key <FILL> and keep pressed until

   ```
   RAM init.
   ```

4. <GO>

   ```
   RAM init. passed
   ```

5. <CLEAR>

   ```
   DOS    0.000 ml
   ```

   Dosimat fills.

   The RAM-initialisation 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:

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

3.4 Releasing a locked spindle with inserted Exchange Unit

The burette drive may very occasionally jam at the top or bottom end of the cylinder. If jamming occurs at the top or when the drive is out of function, the Exchange Unit can no longer removed. In this case, it is necessary to proceed as follows:

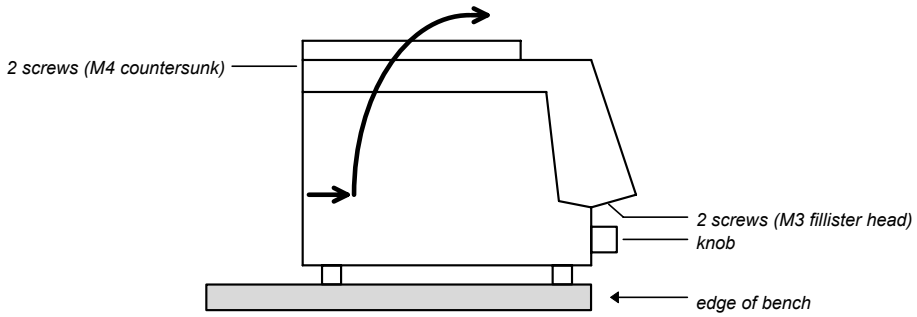


Fig. 4

1. Disconnect instrument from power supply!
2. Remove control knob.
3. Place instrument over edge of bench to allow the M3 screws to be removed.
4. Remove M4 screws.
5. Lift off top part of instrument together with Exchange Unit in the manner shown by the arrow.

The electronic circuits are now accessible!
On no account touch these!

6. Remove spindle from mechanical stop by turning the large gear wheel. (In case that the motor is inoperative, position spindle by hand to zero position.)

4 Operation via RS232 Interface

4.1 General

The Dosimat offers an extensive remote control. Data transmission occurs 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 exceptions 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 recognized only if the Dosimat is in its ready state, see 4.2. If commands are not recognized, the corresponding error bytes of information byte 2 are set and may be inquired with command 'I'.

4.2 Control commands

Command	Explanation	Live	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 ≤ X ≤ 9, J 4.2.18
MRCALL **X**	Mode recall	N	0 ≤ X ≤ 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 ≤ X ≤ 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 analog on	Y	4.2.26
VDA	Rate down analog 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**	Limit volume	N	4.2.31
VLIM **OFF**	Limit volume off	N	4.2.32

Command	Explanation	Live	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.

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

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 = Repeat command in the READY state
3	1 = Cylinder empty
4	1 = Remote control on
5	1 = Data transfer on (send RS232 on)
6	Reserve

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 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 reactivated 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/min	**Volume** $_{max}$ ml/min
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/min	**Volume** $_{max}$ ml/min
1	0.001	0.900
5	0.001	4.9009
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/min	**Volume** $_{max}$ ml/min
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/min	**Volume** $_{max}$ ml/min
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.
Do not query the volume when result calculation in Mode DOS is active!
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)
10000 = 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.

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

Note: bytes 1...4 may have the value of 'CR' and '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 mode DOS.
In other modes, string "not defined 'CR' 'LF'" is transmitted.

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

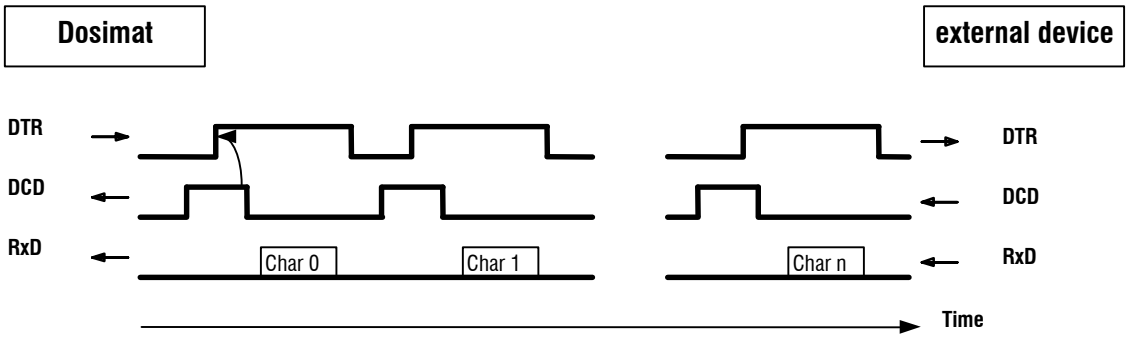
Request to send the information 'auto fill on/off' via RS232 interface.
For example: auto fill on "on 'CR' 'LF'"
auto fill off "off 'CR' 'LF'"

4.3 Handshake and other properties

4.3.1 Handshake full

The arrows show the direction of the signal.

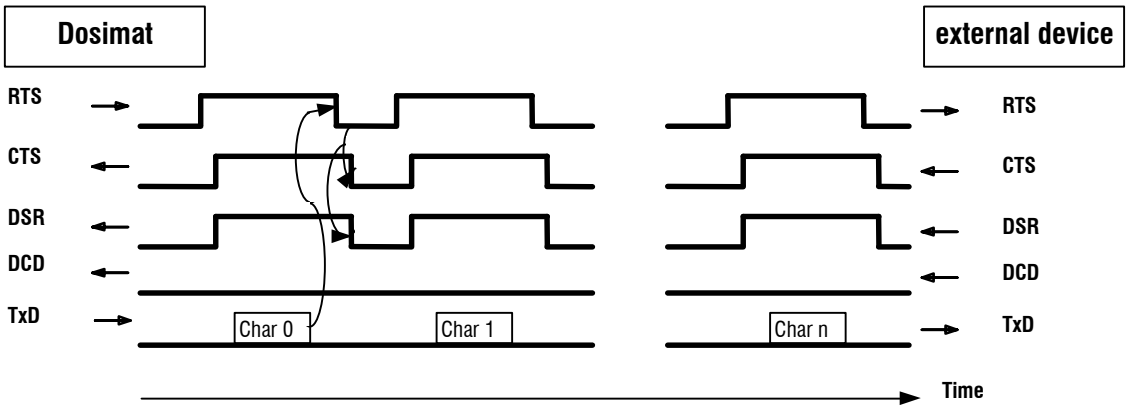
Dosimat as Receiver :



Notes:

- The **DTR** has to be **active** before the external device can transmit.
- The **DTR** has to be **inactive** before setting the DCD.

Dosimat as Transmitter:



Notes:

- During the whole transmission, the **DCD** has to be **inactive** (no duplex service).
- The **CTS** has to be **inactive** before the Dosimat sends 1 character.

4.3.2 Handshake none

The handshake lines are **set** by the Dosimat as above.
The handshake lines are **not checked** by the Dosimat.

4.3.3 General properties of the RS 232 interface

The Dosimat is configured as DTE (Data Terminal Equipment).

The RS 232 interface has the following technical specifications:

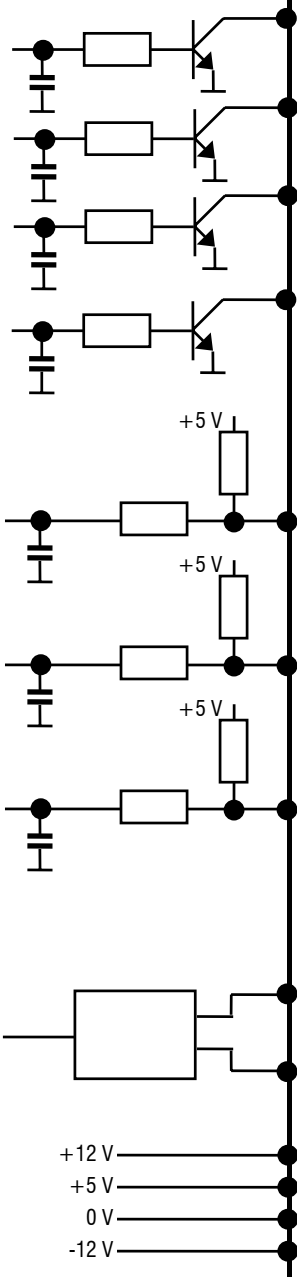
- Data interface according to the RS 232C standard, adjustable transfer parameters, see page 18.
- Control characters: C_R (ASCII DEC 13)
  L_F (ASCII DEC 10)
- Cable length: max. approx. 15 m

Start	7 Data Bit	Parity Bit (even)	1 Stop Bit

Only a shielded data cable (for example, METROHM D.104.0201) may be used to connect the Dosimat with external devices. The cable shield must be properly grounded on both instruments (pay attention to current loops; always ground in a star-head formation). Only plugs with sufficient shielding may be used (for example, METROHM K.210.0381 with K.210.9045).

4.4 Pin assignment of the RS232 / I/O socket

4.4.1 I/O socket, 25 pins



external	Function
A18	Ready = L V_{CE} = 30 V, I_C = 20 mA
A16	Limit volume reached = L V_{CE} = 30 V, I_C = 20 mA
A9	Job end V_{CE} = 30 V, I_C = 20 mA t_p t_p ca.150 ms
A7	Pulses (10000). Appear with feed only. V_{CE} = 30 V, I_C = 20 mA t_p t_p ca. 200 us
A17	Fill = L; during filling t_p $t_p \geq 1$ ms
A20	Feed = L; during dosing t_p $t_p \geq 1$ ms
A6	Change to step operation = L. 1 Dosing pulse on A20 triggers 1/10000 of buret volume. $V_{IL} \leq 0.4$ V $V_{IH} \geq 2$ V $I_{IL} \leq 0.6$ mA
A21	0 mV ... 1000 mV $I_L \leq 5$ mA
A11	Analog Ground
A8	$I_L \leq 30$ mA
A3	$I_L \leq 80$ mA
A4/5	
A2	$I_L \leq 30$ mA

4.4.2 RS232 interface, 25 and 8 pin sockets

Transmitted Data (TxD). If no data are transmitted, the line is held in the “ON” condition. Data will only be sent when CTS is in the ”ON” condition.	A25 and B7
Received Data (RxD)	A22 and B6
Request to Send (RTS) ON condition: Titrino is ready to send data.	A14 and B8
Clear to Send (CTS) ON condition: Remote station is ready to receive data.	A23 and B5
Signal ground (GND)	A4/5 and B1
Data Terminal Ready (DTR) ON condition: Instrument is ready to receive data.	A19 and B4
Data Set Ready (DSR) ON condition: Communication channel is connected.	A1 and B3
Received Line Signal Detector (RLSD) ON condition: The connected device is ready to send data.	A24 and B2

Protective earthing
Direct connection from cable plug to the protective ground of the instrument.

Polarity allocation of the signals
- Data lines (TxD, RxD)
  voltage negative (<-3 V): signal state ”ON”
  voltage positive (>+3 V): signal state ”ZERO”
- Control or message lines (CTS, RTS, DTR, DSR, RLSD)
  voltage negative (<-3 V): OFF state
  voltage positive (>+3 V): ON state

In the transitional range from +3 V to -3 V the signal state is undefined.

Definition of signal states
- Data interchange circuits (TxD, RxD)
  voltage negative (<-3 V): marking condition
  voltage positive (>+3 V): spacing condition
- Timing and control interchange circuits (CTS, RTS, DTR, DSR, RLSD)
  voltage negative (<-3 V): OFF condition
  voltage positive (>+3 V): ON condition

In the transitional range from +3 V to -3 V the signal state is undefined.

Driver 1488	according to EIA RS 232C specification
Receiver 1489A	according to EIA RS 232C specification

Ordering numbers for 25 pin plug (socket A):
K.210.9004 (shell) and K.210.002

Important: The pin numbers are not used according to the RS232 standard version. Therefore do not plug in standard RS232 cables!

Ordering number for 8 pin plug (socket B):
K.101.0004

No liability whatsoever will be accepted for damage caused by improper interconnection of instruments.

5 Appendix

5.1 Technical specifications

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

Resolution 10'000 pulses per 100% of burette volume

Exactitude Metrohm dosimats and exchange units meet the requirements of ISO/EN/DIN Standard 8655-3 "Piston-operated volumetric apparatus – Part 3: Piston burets" and DIN Standard 12 650.

Limits according to ISO/EN/DIN 8655-3

Cylinder volume	Max. permissible system. error		Max. permissible random error	
1 mL	± 0.6%	± 6 µL	± 0.1%	± 1 µL
5 mL	± 0.3%	± 15 µL	± 0.1%	± 5 µL
10 mL	± 0.3%	± 20 µL	± 0.07%	± 7 µL
20 mL	± 0.2%	± 40 µL	± 0.07%	± 14 µL
50 mL	± 0.2%	± 100 µL	± 0.05%	± 25 µL

Metrohm agencies throughout the world offer you the possibility of checking the accuracy of your exchange units and Dosimats locally and also of certifying them. If the dosing cylinder and/or piston of an exchange unit are replaced then we recommend that an accuracy check is carried out.

Dispensing time for 100% of burette cylinder volume

analogue setting	20 s ... app. 17 min
digital setting	20 s ... app. 17 h

Modes

DOS	Dosing, with the ability to calculate a result from the dosed volume
DIS R	Repetitive Dispensing
DIS C	Cumulative Dispensing
PIP	Pipetting
DIL	Diluting
CNT D	Preparation of solutions with preselected content

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

Display LCD, 16 characters
Size of characters: 4.84 x 8.01 mm

Material

Cabinet	Polybutylene terephthalate (PBTP)
Key cover	Polycarbonate (PC)

Ambient temperature

Nominal functional range	+5... +40°C
Storage, transport	- 40... +60°C

Safety specifications Designed and tested in accordance to IEC-Publication 1010, safety class I. This manual contains some information and warnings which have to be followed by the user to ensure safe operation and to retain apparatus in safe condition.

Power supply

Voltage	100, 117, 220, 230/240 V ± 10% (adjustable)
Frequency	50... 60 Hz
Consumption	15 VA
Fuse	Thermal fuse (100°C)

Dimensions

Dosimat with exchange unit	
Width	150 mm
Height	450 mm
Depth	275 mm
Titrating stand with exchange unit	
Width	240 mm
Height	450 mm
Depth	275 mm

Weight

Dosimat with keyboard	app. 3.2 kg
as titrating stand	app. 4 kg

5.2 Warranty and certificates

5.2.1 Warranty

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

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

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

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

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

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

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

5.2.2 Certificate of Conformity and System Validation

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

Name of commodity:	765 Dosimat
System software:	Stored in ROMs
Name of manufacturer:	Metrohm Ltd., Herisau, Switzerland

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

Electromagnetic compatibility: Emission

EN50081-1/92, EN55022/class B, EN55011/class B	Generic emission

Electromagnetic compatibility: Immunity

EN50082-1/92	Immunity
IEC1000-4-2/95 (level 4), NAMUR/93	Static discharge
IEC801-3, ENV50140/93+ENV50204/93 (level 2)	Radiated rf electromag.field immunity
IEC801-4, IEC1000-4-4/95 (level 3)	El.fast transient requirements
IEC801-5, IEC1000-4-5/95 (level 2/3)	"Surges" immunity
NAMUR/93 Paragr. 3.2.2., IEC1000-4-11/94	Voltage dips, short interruptions

Security specifications

IEC1010 class1, EN61010 class1, UL3101-1, EN60947:IP31

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

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

Herisau, May 14, 1998

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

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

CE

EU- Declaration of Conformity

The company Metrohm AG, Herisau, Switzerland, certifies herewith, that the following instrument:

765 Dosimat

meets the CE mark requirements of EU Directives 89/336/EWG and 72/23/EWG.

Source of 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 apparatus:

Universal microprocessor-controlled dispensing unit for liquid handling in laboratories. For titrating and dosing tasks.

Herisau, May 20, 1998

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

5.3 Connection of a balance

The balance is connected to the RS232 output (6) of the Dosimat.

Connecting cable:

Sartorius, MP 8, YDO01...	3.980.3380
Mettler AE, Option 011	3.980.3370 + cable by Mettler: Hand switch ME 42500 or foot switch ME 46278
Mettler AT (15 pin)	Cable by Mettler: ME 33640
Mettler, AM/PM:	Cable by Mettler: ME 33640 + T-Adapter ME47473 + Hand switch ME 42500 or foot switch ME 46278
Mettler, AB/AG (LC-RS25):	3.980.3370 + cable by Mettler: LC-RS25 (Adjustments 7 5 2)
Mettler, PG:	3.980.3370 + 6.2125.130
AND	Cable on demand
Precisa	Cable on demand

Note

- Select the correct balance on the Dosimat (special key 5, see page 18).
- Select the baud rate of the Dosimat such that it corresponds with that of the balance (special key 1, see page 18).
- Select handshake "none" (special key 6, see page 18).
- Weights 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.
- The balance must transmit in mode "g".

5.4 Connection of a printer

The printer is connected to the RS232 output (6) of the Dosimat.

Important: Switch Dosimat on first, then printer.

Connecting cable:

Seiko DPU-414	6.2124.060 + 6.2125.130
Citizen iDP562	6.2124.070
Epson LQ, FX with interface #8148	6.2124.070
Epson LX-300	6.2124.070

Printer:

Seiko DPU-414, 230 V	2.141.0014
Seiko DPU-414, 120 V	2.141.0015
Citizen iDP562, 230 V	2.140.0024
Citizen iDP562, 115 V	2.140.0025

5.5 Continuous dosing with two Dosimats

Two 765 Dosimats are suitable for continuous dosing.
The two 765 Dosimats are connected with cable 3.980.3140 via both interfaces RS232 (6).

Procedure

- Select mode DIS C in both Dosimats.
- Set on both Dosimats the dispensing volume equal to the volume of the mounted exchange unit (V-DIS = $V_{burette}$).
  If one of the Dosimats is started and reaches the preselected dispensing volume, this triggers the start of the other Dosimat, etc.
- Prerequisite for continuous dosing is that the filling rate is higher than the expelling rate (while one Dosimat is expelling, the other one is refilling i.e. in addition to the movement of the piston two turns of the cock are necessary, about 2 s for each turning).
  Example: rate $\uparrow \leq 0.85$ rate $\downarrow_{max}$ for the smaller of the exchange unit

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.

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

- Calculation of the number of complete cycles N (V_1 **and** V_2 be completely expelled):

$$N = \text{INT}\frac{V}{V_1 + V_2} \text{ (integral quotient)}$$

- Calculation of the remaining volume V_R:

$$V_R = V - N * (V_1 + V_2)$$

- In case the remaining volume is $V_R = 0$, Dosimat 2 is the final burette.

Settings on Dosimat 1:		*Settings on Dosimat 2:*	
V-LIM(1)	= OFF	V-LIM(2)	= $N * V_2$
VDIS(1)	= V_1	V-DIS(2)	= V_2

- In case the remaining volume is $V_R \neq 0$ and $V_R \leq V_1$, Dosimat 1 is the final burette.

Settings on Dosimat 1:		*Settings on Dosimat 2:*	
V-LIM(1)	= V - N * V_2	V-LIM(2)	= OFF
VDIS(1)	= V_1	V-DIS(2)	= V_2

- In case the remaining volume is $V_R \neq 0$ and $V_R > V_1$, Dosimat 2 is the final burette.

Settings on Dosimat 1:		*Settings on Dosimat 2:*	
V-LIM(1)	= OFF	V-LIM(2)	= V - V_1 * (N + 1)
VDIS(1)	= V_1	V-DIS(2)	= V_2

with
V_1 cylinder volume on Dosimat 1 (start Dosimat)
V_2 cylinder volume on Dosimat 2

Example:
Continuous dosing of 55 mL. Exchange units with volumes of 20 mL and 10 mL.

Key:
End volume $V = 55$ mL
Exchange unit 1 $V_1 = 20$ mL
Exchange unit 2 $V_2 = 10$ mL

1. $N = Int\frac{55}{20+10} = 1$
2. $V_R = 55 - 1*(20+10) = 25$
3. *25 (V_R) is larger than 20 (V_1), i.e. Dosimat 2 is the final burette.*
4. *V-LIM for Dosimat 2 is: 55-20*(1+1) = 15*

Settings:

Dosimat 1 (start Dosimat)	*Dosimat 2 (final Dosimat)*
20 mL Exchange unit	*10 mL Exchange unit*
V-DIS = 20 mL	*V-DIS = 10 mL*
V-LIM = OFF	*V-LIM = 15 mL*
rate ↑ = 25.5 mL/min	*rate ↑ = 25.5 mL/min*
rate ↓ = 60 mL/min	*rate ↓ = 30 mL/min*

The rate ↑ of 25.5 mL/min is the highest possible value for the predefined configuration.

5.6 Scope of delivery and ordering designations

Dosimat 765 .....2.765.0010
including the following accessories:

1 Push button cable 6.2107.000
1 Keypad for Dosimat 765..... 6.2149.000
1 Key for Exchange units..... 6.2739.010
1 806 Exchange Unit with 20 mL glass cylinder 6.3026.220
1 Power cable with cable socket, type CEE(22), V
Cable plug to customer's specifications
type SEV 12 (Schweiz...)..... 6.2122.020
type CEE(7), VII (Deutschland...)..... 6.2122.040
type NEMA/ASA (USA...) 6.2122.070
1 Instructions for Use for Dosimat 765..... 8.765.1023
1 Quick References for Dosimat 765..... 8.765.1013

Dosimat 765 with built-in analogue output 2.765.0020
Accessories the same as with 2.765.0010.

Dosimat 765 as titrating stand 2.765.0030
including the following accessories:

1 Magnetic stirrer 1.728.0010
1 Magnetic stirring bar, 16 mm 6.1903.020
1 Magnetic stirring bar, 25 mm 6.1903.030
1 Base plate with stand rod..... 6.2001.010
1 Clamping ring for electrode holder..... 6.2013.010
1 Electrode holder 6.2021.020
1 Push button cable 6.2107.000
1 Keypad for Dosimat 765..... 6.2149.000
1 Key for exchange units..... 6.2739.010
1 806 Exchange Unit with 20 mL glass cylinder 6.3026.220
1 Power cable with cable socket, type CEE(22), V
Cable plug to customer's specifications
type SEV 12 (Schweiz...)..... 6.2122.020
type CEE(7), VII (Deutschland...)..... 6.2122.040
type NEMA/ASA (USA...) 6.2122.070
1 Instructions for Use for Dosimat 765..... 8.765.1003
1 Quick References for Dosimat 765..... 8.765.1013

Dosimat 765 with built-in analogue output, as titrating stand 2.765.0040
Accessories the same as with 2.765.0030.

Options

Accessories to separate order and on payment of extra charge:

806 Exchange Unit **6.3026.xxx**
Buret unit for Metrohm Dosimats, Titrinos, Titrandos; with glass cylinder, PCTFE/PTFE flat cock and built-in data chip

806 Exchange Unit with 1 mL glass cylinder 6.3026.110
806 Exchange Unit with 5 mL glass cylinder 6.3026.150
806 Exchange Unit with 10 mL glass cylinder 6.3026.210
806 Exchange Unit with 20 mL glass cylinder 6.3026.220
806 Exchange Unit with 50 mL glass cylinder 6.3026.250
Ceramic flat cock 6.1542.010

Stirrer and working equipment
728 Magnetic stirrer..... 2.728.0040
Magnetic stirring bars, length
12 mm.....6.1903.010
16 mm.....6.1903.020
25 mm.....6.1903.030
802 Rod stirrer..... 2.802.0010
Electrode holder.....6.2021.020
Pipetting equipment.....6.5611.000
Dosing Test: Automatic execution of GLP tests, PC program.....6.6025.000

Cables
Cable 765 Dosimat — 682, 686, or 678 Titroprocessor..... 3.980.3090
Cable 2 x 765 Dosimat — 682, 686, or 678 Titroprocessor..... 3.980.3100
Cable 765 Dosimat — 670 Titroprocessor or 646 VA-Processor..... 6.2124.010
Cable 765 Dosimat — 586 Labograph 3.980.3170
Cable 765 Dosimat — Dosimat 765 ..... 3.980.3140
Double plug for 25 pin socket..... 6.2125.000

Balance connection
Cable 765 Dosimat — Sartorius, MP 8, YDO01..... 3.980.3380
Cable 765 Dosimat — Mettler AE, Option 011 ..... 3.980.3370
Cable 765 Dosimat — Mettler AT (15 pin) .....from Mettler: ME 33640
Cable 765 Dosimat — Mettler, AM/PM ..... from Mettler: ME 33640 + ME47473
Cable 765 Dosimat — Mettler, AB/AG (LC-RS25) .....3.980.3370 + from Mettler LC-RS25
Cable 765 Dosimat — Mettler, PG..... 3.980.3370 + 6.2125.130

Printer connection
Printer Seiko DPU-414, 230 V 2.141.0014
Printer Seiko DPU-414, 120 V 2.141.0015
Printer Citizen iDP562, 230 V..... 2.140.0024
Printer Citizen iDP562, 115 V..... 2.140.0025
Cable 765 Dosimat — Seiko DPU-414 ..... 6.2124.060 + 6.2125.130
Cable 765 Dosimat — Citizen iDP562 ..... 6.2124.070

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Keys are marked with < >, **display texts** are in bold characters, and pages concerning the green part are *printed in italic.*