Metrohm

CH-9101 Herisau/Switzerland
Tel. +41 71 353 85 85
Fax +41 71 353 89 01
E-Mail sales@metrohm.ch
Internet http://www.metrohm.ch

776 Dosimat

Instructions for Use

8.776.1023

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

7 Power connection
In power supply systems, in which strong HF interferences (transients) are superimposed on the power voltage, the 776 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.

8 Power switch
Switching on and off Dosimat. The 776 Dosimat is equipped with a non-volatile memory, i.e. set parameters remain in the working memory if the Dosimat is switched off and on.

9 Earthing socket
The 776 Dosimat must be grounded correctly and effectively, if necessary through the separate earthing socket.

10 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).

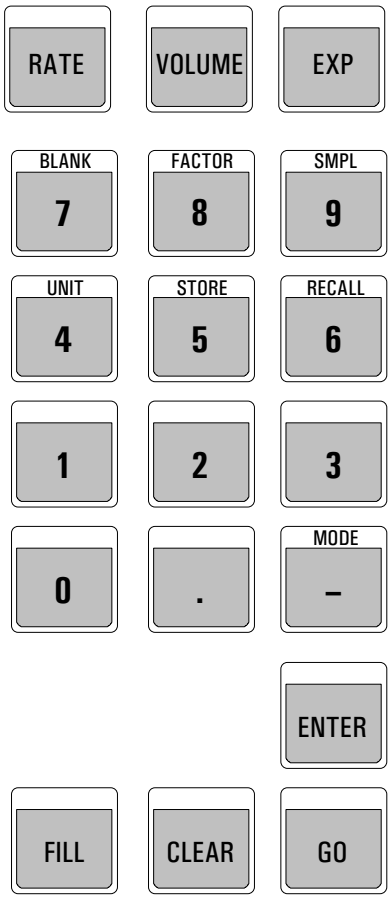
11 Connection for external dosing contact
E.g. 6.2107.000 push button cable.

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

13 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. The resolution on the display is therefore depending on the mounted Exchange unit.

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 mounted, the value is rounded off to the next possible one and stored accordingly.

- 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 .

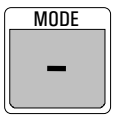
↑ ml/min Expelling rate
Range for digital setting depending on volume of Exchange unit:

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 776.
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.

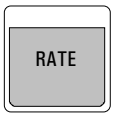
All modes which are loaded into the working memory by key <MODE> are equipped with a set of standard parameters:

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

`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:

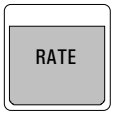
$$\text{Result} = \frac{(\text{dosed volume} - \text{blank}) * \text{factor}}{\text{smpl}}$$

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.

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



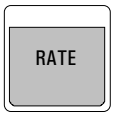
Expelling and filling rate, see page 6.

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.

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!

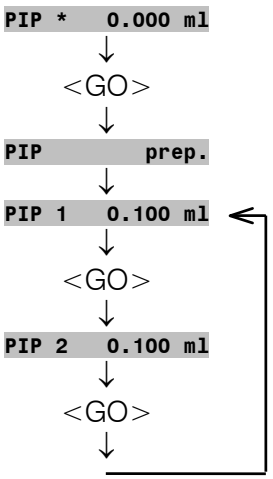
RATE

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

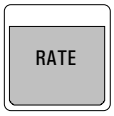
Aspirating a stored pipetting volume and subsequent expelling of the pipetting and diluting volume.

`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.

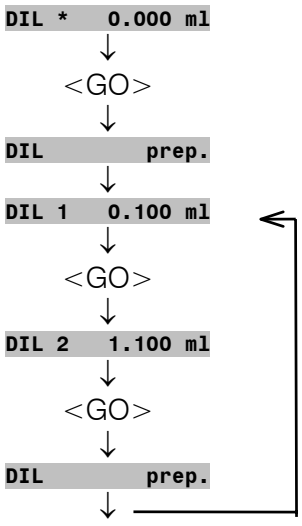
If mode DIL is loaded, the display shows `DIL * 0.000 ml`.

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.

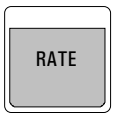
Ready to expel the pipetting and diluting volume: Hold burette tip for pipetting.

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 776 Dosimat dispenses the amount of solvent calculated correspondingly.

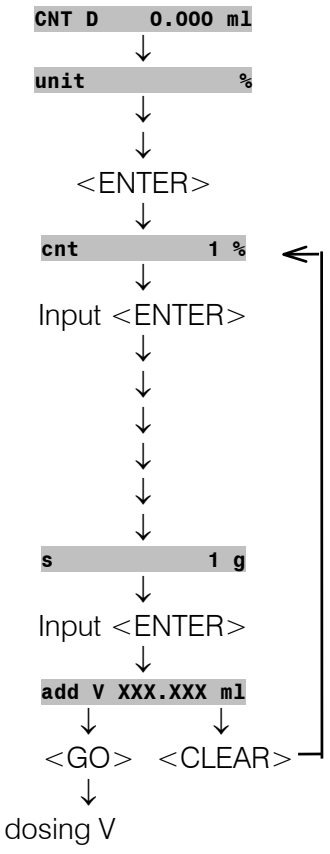


Expelling and filling rate see page 6.

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.

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.

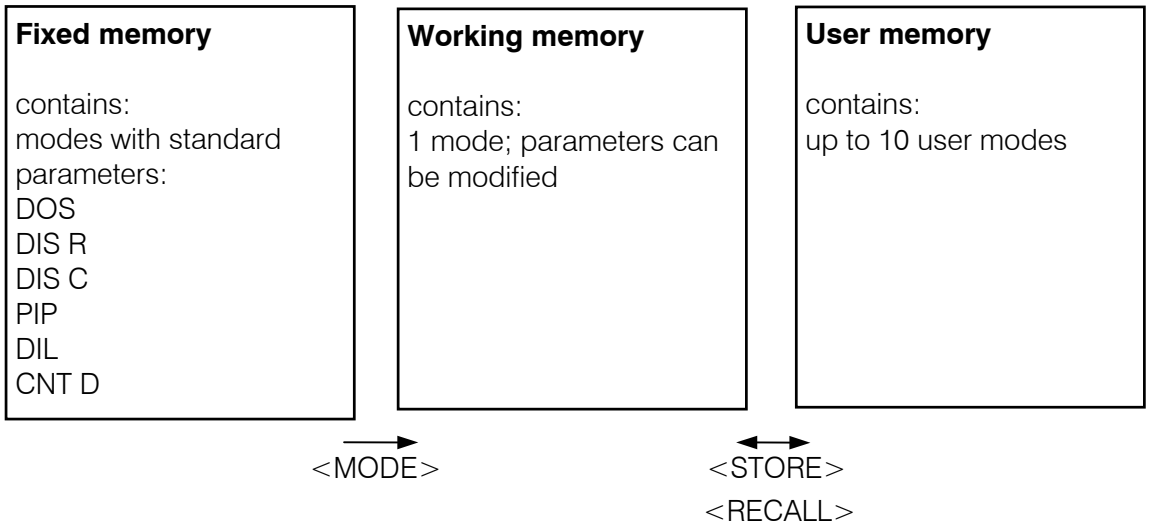
Several correction factors are shown in the following table:

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

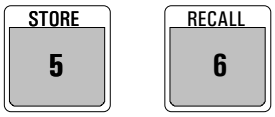
2.3 User memory

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 either key <0> or <3>. The other keys have no meaning. 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 >	`5.776.0010`	Display of program number
< 3 >	`auto fill on`	Automatical refilling in mode DOS if more than one burette volume has been expelled: on = yes; off = no. Press <GO> until the right answer is displayed and store with <ENTER>.

3 Error messages, troubleshooting

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 776 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
-.---.----	Stop watch or watch with second hand.

3.2.2 Summary

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3.2.6 Diagnosis of display 23
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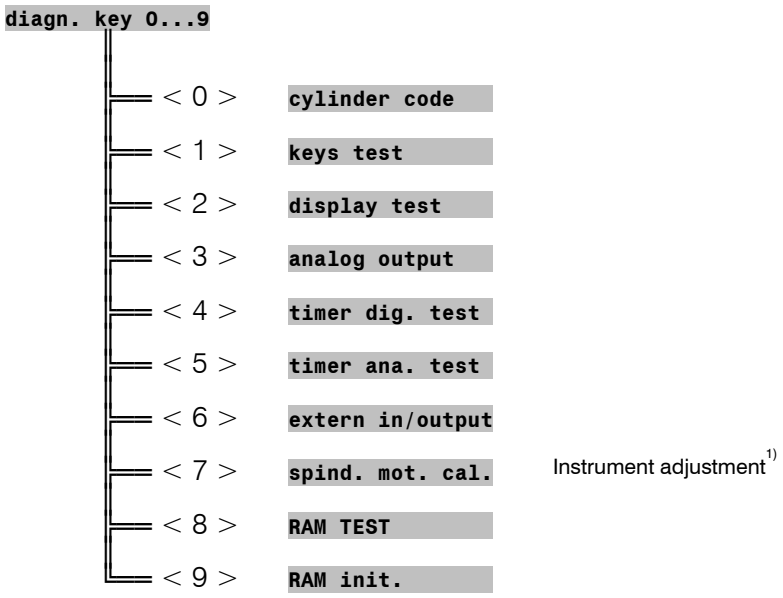
3.2.9 RAM-test 25
3.2.10 Diagnosis of spindle zero and cock changeover 25
3.2.11 Diagnosis of spindle drive 26

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
```

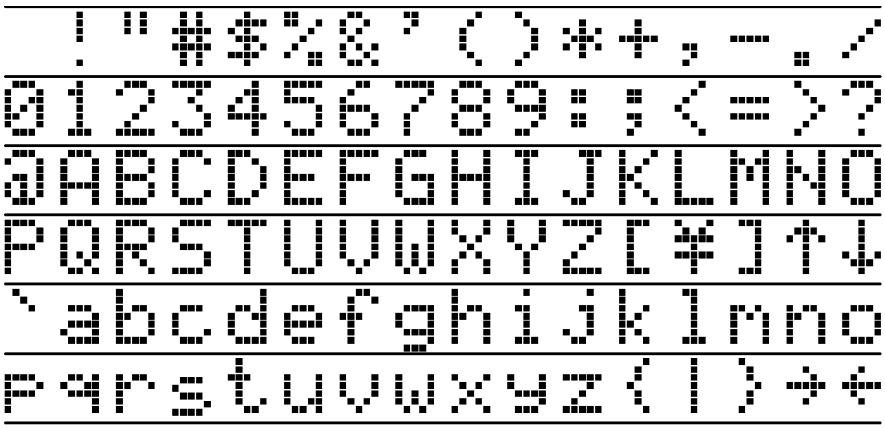


Fig. 1

3.2.7 Diagnosis 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
   ```

3.2.8 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
   ```

3.2.9 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
   ```

3.2.10 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).

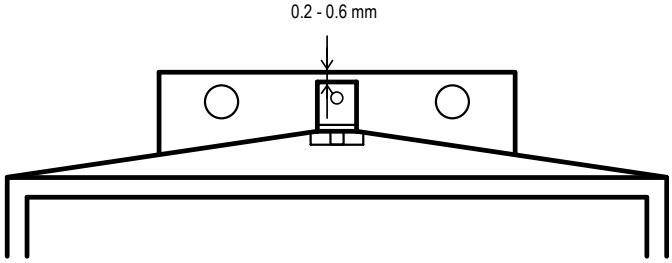


Fig. 2

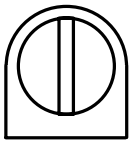


Fig. 3

3.2.11 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:

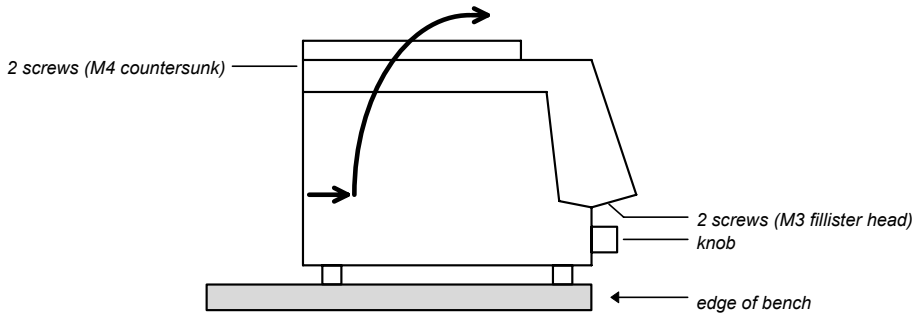


Fig. 4

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 Appendix

4.1 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

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

Weight

Dosimat with keyboard app. 3.1 kg

4.2 Warranty and certificates

4.2.1 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.

4.2.2 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:	776 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
776 Dosimat

CE

EU- Declaration of Conformity

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

776 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

4.3 Scope of delivery and ordering designations

Dosimat 776 .....2.776.0010
including the following accessories:

1 Push button cable 6.2107.000
1 Keypad for Dosimat 776 ..... 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 776..... 8.776.1023
1 Quick References for Dosimat 776 ..... 8.776.1013

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
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16 mm.....6.1903.020
25 mm.....6.1903.030
802 Rod stirrer..... 2.802.0010

Electrode holder.....6.2021.020

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Adaptor cable for pipetting equipment 6.2136.000

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<VOLUME> 4
V > XXXX ml 19
V < XXXX ml 19
V-DIL 11
V-DIS 9
V-LIM 7, 9
V-LIM reached! 20
volume<resol.! 20
V-PIP 10, 11
V-PIP > V(B) 20

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