

# Medicine Devices



## ***USER MANUAL*** ***MDC 1000vet***

# MDC 1000vet

## Semi-automated hematology analyzer for blood count

Operator manual 1.0  
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Disclaimer:

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# 1 INTRODUCTION

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Hematology deals with the study of blood diseases and diseases of the blood-building organs, which, because of their sensitivity indicate certain pathological conditions quite clearly.

Blood is the most important transport organ of the body. The substances to be transported are either dissolved in the blood serum or are carried by the blood corpuscles. An example for the first group is electrolytes and hormones, an example for the second is oxygen that is carried by the erythrocytes.

Certain pathological conditions are reflected in the change in the amount or in the quality of the blood corpuscles, e.g. volume or content.

The **Hematology System** serves to establish what is called the small blood picture.

The easy handling of the instrument and the simple processing of the samples allows the instrument to be used anywhere without problems.

The instrument version with the built-in analyzer can determine the particle size and the number of **PLT simultaneously with the RBC** measurement from whole blood dilution. Additional information is displayed in case of abnormal distributions.

However, please note those blood cells are particles of the same size as for example dust particles and other pollution. Blood cells react with great sensitivity to changes in their physical surroundings.

**Therefore, the exactness of your measuring results depends not only on the system itself, but also to a large extent on how the system is handled, on how the blood is processed and on the quality of the solutions that are used.**

Of course, the handling of the system will affect the total result most, while good results will in turn affect your satisfaction with the instrument.

The handling of the system is uncomplicated. However, the recommendations of the manual concerning handling, cleaning and maintenance should be followed carefully, as even the best system cannot function without a certain amount of maintenance and users knowledge about the functioning of the instrument.

The following chapters want to give you the necessary knowledge about handling and maintenance to insure the trouble-free working of the instrument.

## 1.1 GENERAL

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As the system possibilities of data-display are limited, the customary international abbreviations of parameters are used on the display

### **Abbreviations and their meanings:**

<b>RBC</b>	-	Amount of Red Blood Cells (erythrocytes)
<b>WBC</b>	-	Amount of White Blood Cells (leukocytes)
<b>PLT</b>	-	Amount of blood Platelets (thrombocytes)
<b>MPV</b>	-	Mean Corpuscular Volume (average cell size, thrombocytes)
<b>HCT</b>	-	Hematocrit (packed cell volume in %)
<b>MCV</b>	-	Mean Corpuscular Volume (average cell size, erythrocytes)
<b>MCH</b>	-	Mean Corpuscular Hemoglobin (average HGB weight/cell)
<b>MCHC</b>	-	Mean Corpuscular Hemoglobin Concentration (Average Hemoglobin concentration in %)
<b>HGB</b>	-	Hemoglobin concentration

## 1.2 NORMAL VALUES

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Animal	WBC x10 <sup>3</sup> /µl	RBC x10 <sup>6</sup> /µl	HGB g/dl	HCT %	MCV fl	PLT x10 <sup>3</sup> /µl,
Hamster	4,5 - 8,4	6,5 - 8,2	14,1 - 17,6	42 - 50	60 - 67	250 - 572
Dog	9,8 - 28,6	5,7 - 9,5	13,4 - 22,9	37 - 65	64 - 74	177 - 520
Rabbit	4,4 - 13,4	4,2 - 8,5	9,8 - 18,0	35 - 50	55 - 75	115 - 941
Cat	5,5 - 19,5	5,0 - 10,0	8,0 - 15,0	24 - 45	39 - 55	300 - 800
Mouse	3,9 - 13,8	6,5 - 10,8	2,1 - 17,0	35 - 47	43 - 56	830 - 2155
Guinea pig	2,2 - 10,8	4,6 - 6,4	12,6 - 16,8	38 - 50	24 - 28	319 - 966
Horse	5,4 - 14,3	6,8 - 12,9	11,0 - 19,0	32 - 53	37 - 59	100 - 350
Rat	4,2 - 17,1	5,1 - 9,1	11,2 - 17,3	32 - 49	48 - 66	335 - 1569
Cow	4,0 - 14,1	6,3 - 10,0	7,6 - 15,5	22 - 43	35 - 59	054 - 640
Sheep	3,2 - 11,9	6,0 - 15,0	8,7 - 15,1	20 - 45	28 - 40	250 - 750
Pig	9,9 - 40,1	4,9 - 8,1	8,3 - 14,5	26 - 45	46 - 64	107 - 605

### Calculation Example for Additional Parameters

$$\text{MCH} = \frac{\text{HGB}}{\text{RBC}}$$

$$\text{MCHC} = \frac{\text{HGB}}{\text{HCT}}$$

## **2 FUNCTIONAL UNITS**

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### **2.1 PARTS OF EQUIPMENT**

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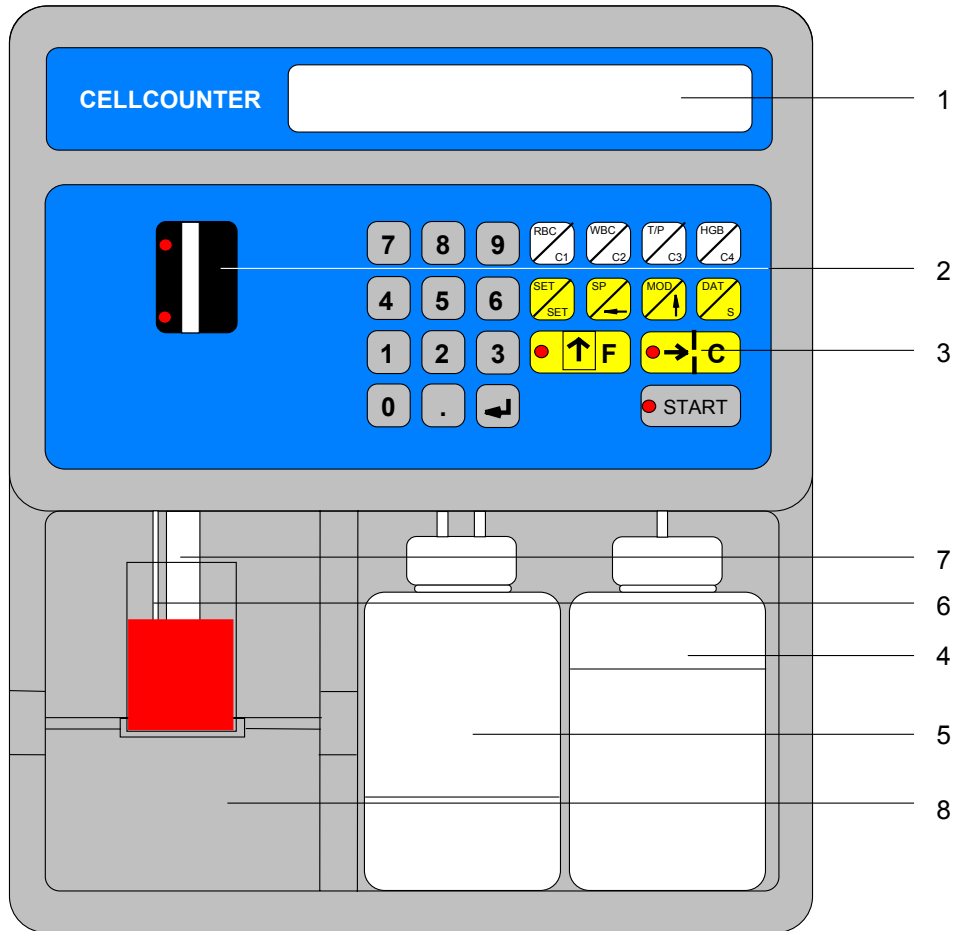
- |                         |   |   |
|-------------------------|---|---|
| 01. Display             | - | Display for measurement/working instructions                            |
| 02. Inspection Window   | - | Control of the measuring system surveillance                            |
| 03. Keyboard            | - | To feed the system with figures   |
| 04. Filling Bottle      | - | Supply bottle for filling the measuring system                          |
| 05. Waste Bottle        | - | Collection container for waste  |
| 06. Reference Electrode | - | Voltage feed HGB-Suction Probe<br>Probe for the suction of HGB-solution |
| 07. Aperture-tube       | - | Instrument transducer(capillary aperture)                               |
| 08. Platform            | - | For the solution during the measuring cycle                             |
| 09. Mains Switch        | - | Mains switch to switch on the instrument                                |
| 10. Plug/Power Switch   | - | main switch and mains connection  |
| 11. Fuse                | - | for mains connection  |
| 12. Parallel Connector  | - | for printer connection  |
| 13. Serial Connector    | - | for computer connection   |

## **2.2 The Keyboard**

01. RBC - key - to count the red corpuscles
02. WBC - key - to count the white corpuscles
03. T/P - key - to count the platelets
04. HGB - key - to measure the hemoglobin-standard
05. START - key - starts all working functions
06. FILL - key - to fill the measuring system
07. CLEAN - key - to clean the capillary aperture.
08. Set/Set - key - menu-button
09. SP - key - to feed the sample number
10. Mod - key - function choice button
11. DAT - key - to feed the date
12. Number-key - to type in the numerical values
13. Enter-key - for confirming the input

## 2.2.1 Diagram of the Equipment

Dia. 1 The Instrument and its functions (front)

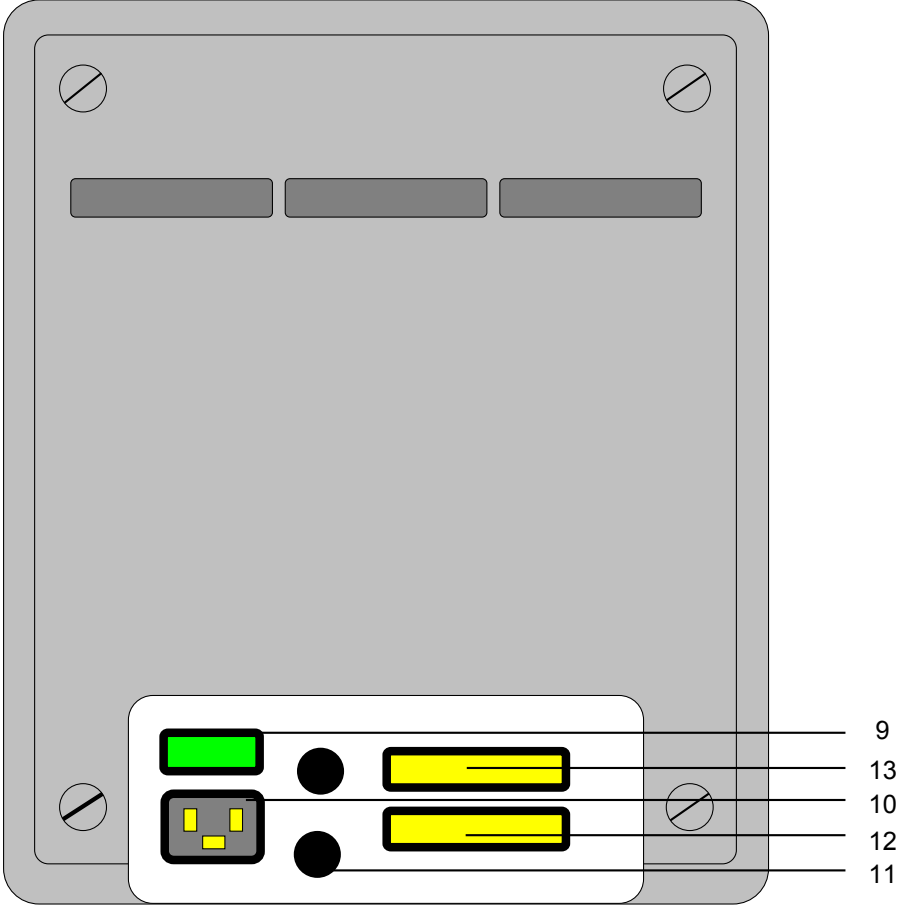


### Functional units

- |                    |                       |                       |
|--------------------|-----------------------|-----------------------|
| 01. Display        | 02. Inspection Window | 03. Keyboard          |
| 04. Filling Bottle | 05. Waste Bottle      | 06. Outside electrode |
| 09. Capillary      | 08. Platform          |                       |

**2.2.2 Diagram of the Equipment**

**Dia. 2 The Instrument and its functions (back)**



**Functional units**

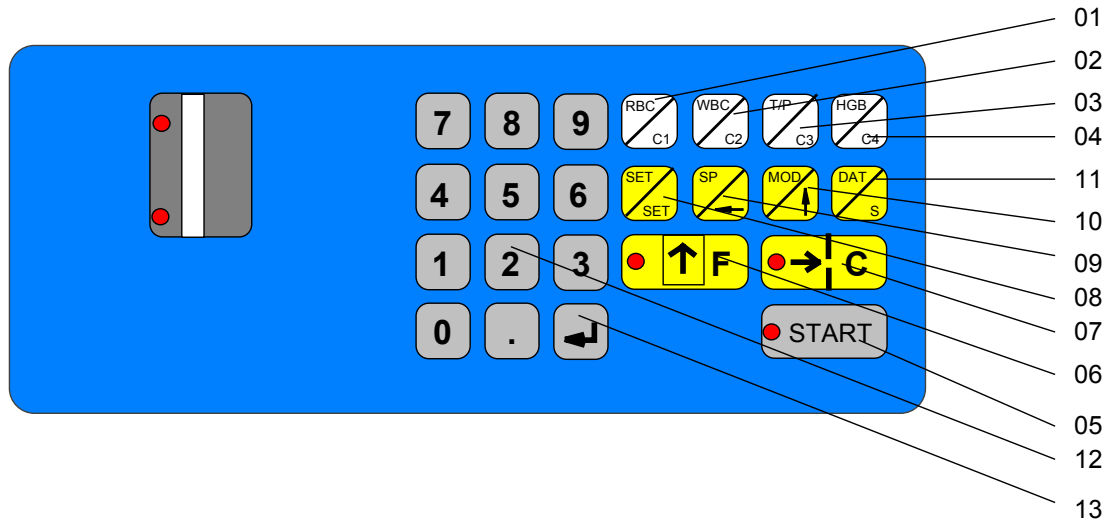
09. Mains Switch  
12. Printer Port

10. Plug  
13. Serial Port

11. Fuse

### 2.2.3 Diagram of the Equipment

**Dia. 3 The Instrument and its functions (Keyboard)**



#### **Functional units**

01. RBC-button  
04. HGB-button

02. WBC-button

03. PLT-button

05. START-button  
08. SET-button  
11. DAT-button

06. FILL-button  
09. SP-button  
12. NO.-button

07. CLEAN-button  
10. MOD-button  
08. ENTER-button

#### **2.2.4 Definition of Text Indicator**

<b>TEST</b>	-	Auto test and automatic calibration when system is switched on.
<b>TIME</b>	-	System and time reading control over START-button (when all parameters are off)
<b>SEC</b>	-	Second indicator of stop watch
<b>RBC</b>	-	Erythrocytes
<b>WBC</b>	-	Leukocytes
<b>PLT</b>	-	Platelets, Thrombocytes
<b>MPV</b>	-	Mean Particle Volume
<b>HGB</b>	-	Hemoglobin
<b>HCT</b>	-	Hematocrit
<b>MCV</b>	-	Mean Corpuscular Volume

## **2.3 EXPLANATION OF TEXT USED ON DISPLAY**

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### **2.3.1 Equipment Displays and their Meanings**

The **Hematology System** is controlled by a microprocessor and has a alphanumeric display. Disturbances are shown on the display.

#### **The processor has the following functions:**

- 1. Control of the complete mechanical course**
- 2. Processing of the measured values**
- 3. Error control**
- 4. Control of the indicator**

### 2.3.2 Indicator Text

<b>TESTING !</b>	-	Control of working system
<b>TIME</b>	-	Control of measuring time
<b>00,0</b>	-	Zero of stop-watch
<b>SEC</b>	-	Seconds
<b>MOD</b>	-	Model 901
<b>RBC</b>	-	Erythrocytes
<b>WBC</b>	-	Leukocytes
<b>PLT</b>	-	Platelets, Thrombocytes
<b>MPV</b>	-	Mean Particle Volume
<b>HGB</b>	-	Hemoglobin
<b>HCT</b>	-	Hematocrit
<b>MCV</b>	-	Mean Corpuscular Volume
<b>FILLING SYSTEM !</b>	-	System is filling from the fill-bottle
<b>CLEANING !</b>	-	Pressure on capillary
<b>MEASUREMENT NO:</b>	-	Measuring cycle No.
<b>HGB: 14,2</b>	-	HGB-calibration value
<b>RAM ERROR</b>	-	Memory error or battery defect
<b>DAT:</b>	-	Date
<b>SP:</b>	-	Sample-number / cursor key
<b>PLT " L "</b>	-	Thrombocytes "noise level bad"
<b>PLT " R "</b>	-	Distortion of curve through large particles which amount to more than 10% RBC-interference or abnormal platelets diameter.
<b>PLT " M "</b>	-	MPV abnormally small

<b>SINGLE MEASUREMENT !</b>	=	Result will be printed out after meas.
<b>DELETE SERIES ? YES=START !</b>	=	Data memory will be deleted
<b>PRINTING SERIES ? YES=START !</b>	=	Data memory will be printed

### 2.3.3 Suggestions for the Elimination of Errors

<b>CAPILLARY LOCKED !</b>	=	Start cycle too long
<b>CAPILLARY BLOCKED !</b>	=	Capillary control time too long
<b>AIR IN SYSTEM, PLEASE FILL !</b>	=	Air bubble during measurement
<b>OVERTIME CLEAN ? FILL?</b>	=	Measuring time too long
<b>UNDERTIME: AIR ?</b>	=	Measuring time too short
<b>AIR IN SYSTEM</b>	=	Stop-light-barrier responded before start-light-barrier
<b>FUNCTION ABORTED !</b>	=	Stop-key or safety light-barrier activated
<b>RAM ERROR !</b>	=	Data memory error
<b>MEMORY FULL !</b>	=	Data memory full

#### **2.3.4 Function-description**

The waste-bottle collects the waste of the measuring solution. It originates 200 µl waste per measurement and approximately 2.5 ml per HGB-determination.

The fill-bottle should always be filled up with Celloton. Exchange Celloton in filling-bottle ca. every 2 - 3 weeks.

The function of the outside-electrode is to suck in the solution for the HGB-determination and provides for the current.

The capillary serves as measuring transducer. By using the standard-volume-unit it takes 200 µl test-liquid for a count of the particles.

## 3 ASSEMBLY OF THE INSTRUMENT

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### 3.1 INSTALLATION

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Remove the lid, check if all parts and plugs are in correct position.  
Plug in mains.

Fill supply bottle with isotonic solution, place supply tube in the provided hole of the plastic bottle and let it sink to the bottom of the bottle.

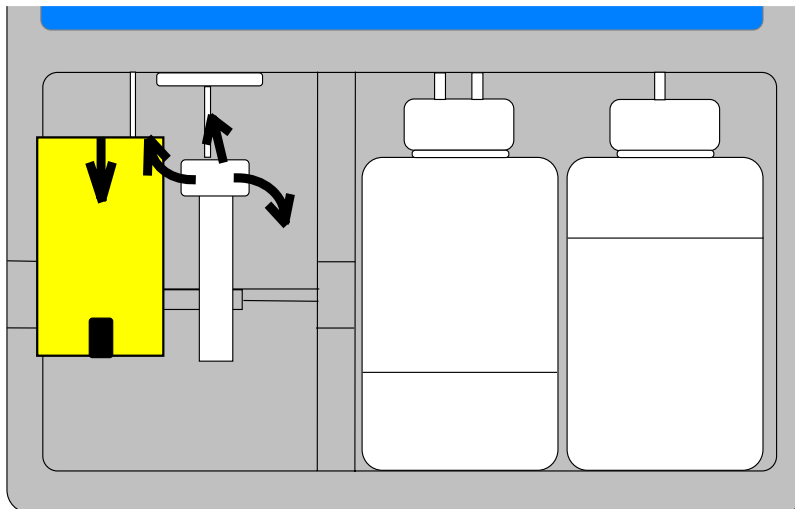
Place the waste tubes to the waste bottle.

#### 3.1.1 Fitting the Capillary

As seen in Dia. 2, the capillary is placed into the measuring chamber as follows:  
Remove screw-lid and insert capillary into the screw-lid.  
Now screw in the capillary with the screw-lid with moderate strength.

#### Dia. 4 Fitting the Capillary

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**Note:**

The delivered protection for the capillary is only used for high frequency disturbances and can be removed if it is not necessary.

## 4 FUNCTION PANEL

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The keyboard of the **AL901** has been subdivided into equipment control keys, function choice buttons, numeric keys and measuring range choice buttons.

The measuring range choice buttons are in white colour, the equipment control keys and function choice buttons are beige, the numeric keys are grey and the start button is green.

### 4.1 THE NUMERIC-KEYS

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#### 4.1.1 The number-key 0-9

With the **NUMERIC-keys** the results of the adjustments can be changed.

#### 4.1.2 0.0.1. The DOT-key

With the **DOT-key** a dot can be set into numbers.

#### 4.1.3 0.0.2. The ENTER-key

With the **ENTER-key** all inputs and options will be confirmed.

### 4.2 THE FUNCTIONAL KEYS

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#### 4.2.1 FILL-button

Press **F-button** briefly. System is filled automatically through the supply bottle.

**When the system is being filled, there must be solution under the capillary.**

This cycle is only needed when the capillary is changed or if there are bubbles in the measuring system.

#### 4.2.2 The START-button

By pressing the **START-button**, the measuring cycle will be started. The measuring channel will be emptied, the value will be set to zero. The button is illuminated during the measuring cycle. After the measuring cycle is finished the measured values of the chosen parameters can be seen on the display.

If the lower start-control of the measuring unit was not reached within 30 seconds or within the correct measuring time, the system carries out an automatic repetition. When this fails also, the instrument interrupts the measuring cycle and indicates an error message.

The **START-button** is also used as **CONFIRMATION-button** after inputs through the **keyboard** or as **STOP-button (while measurements in order to interrupt)**.

### **4.2.3 CLEAN-button**

**C-button** has two functions. It serves either for the cleaning of the measuring- or of the HGB-system.

By a small blocking of the capillary it is possible, through operating of the **clean-button**, to practice a pressure through the inside pump-system on the capillary-orifice.

The adjusted cleaning-time indicates the length of the pressure.

A special cycle is carried out. The HGB-photometer uses a tube valve. Thus, when the instrument was not used for a longer period, it can happen that the tube sticks together at the valve.

In this case choose HGB-range, place a cup with cleaning solution under the waste tube, push the **C-button** and keep it pressed.

This way solution is sucked in through the waste tube and pressure is given onto the sticky tube so that the tube will be cleaned.

If this procedure is repeated the cup under the capillary must be emptied in order to avoid an overflow of the cup.

### **4.2.4 AREA-SELECTION-buttons**

Through the **AREA-SELECTION-buttons** the measuring-parameters are chosen.

If the parameter on the display is switched off, you automatically enter into the time-mode to control the measuring time.

## **4.3 FUNCTION MENU-CHOICE- BUTTONS**

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### **4.3.1 The Set / Set-key**

By pressing of the **SET-button** the calibration can be changed after a measurement.

### **4.3.2 The SP / ← -key**

By pressing the **SP-button** a memory-number, which is increased after each measurement, can be typed in.

The memory number can be changed after every measuring.

Also it is used as a delete key.

### **4.3.3 The MOD / ↑ - key**

By pressing the **MOD-key** the animal can be selected (Number Key 1 – 10).

By pushing the key several times further animal are shown and can be chosen.

Confirm with ENTER-key or type in the corresponding number of the animal.

### **4.3.4 The DAT / S-key**

By pressing the **DAT-key** the **options-menu** opens.

By pushing the key several times further options are shown and can be chosen.

If the user is in the "Time Mode" the actual time and date can be changed after pushing the DAT key.

If you are in the "Measuring Menu" the printout can be set (single printout or series)

#### **4.4 THE DISPLAY, TEXT AND ITS MEANINGS**

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The **AL901** is equipped with a LCD-display.

The results and the parameter are shown on the display in usual abbreviations.

For the counted RBC, e.g. a value is reported "4,45".

This means the tests material contains "4.450.000" particles per  $\mu\text{l}$ .

For the counted WBC, e.g. a value is reported to "4,2".

This means the tests material contains "4.200" particles per  $\mu\text{l}$ .

For the counted PLT:

An indication of 284 means, the tests material contains 284.000 particles per  $\mu\text{l}$ .

For the measured HGB, e.g. a value is reported to "13,2".

This means the tests material contains "13.2" particles per gr/100 ml.

#### 4.4.1 Test of Instrument

Fill measuring cup with isotonic solution and place it under the measuring capillary. Switch on the instrument with the mains switch (7).

For “F” , “C” and “START” - button, the following applies:

**Button lights up** = **Function on**  
**Button does not light up** = **Function off**

All details on the indication are carried out into optical character not in numbers.

**THIS IS THE LCD-DISPLAY**

After the instrument was switched on information on the system version appear.

**TESTING (7.1) (DOG)**

Push “F”-button briefly

**FILLING SYSTEM !**

The system is being filled.

When the filling cycle is correct, the lower LED-control lights up in the inspection window and the measuring tubes of the volume unit are free of bubbles. When the tube system was empty, it is possible that the procedure has to be repeated several times.

In order to carry out a system test, switch off all parameters and press **START-button**.

**TIME 00,0 SEC**

This procedure carries out a measuring time control. Simultaneously a mechanic check and a check of the capillary are carried out.

**TIME 10,5 SEC (+ 1,5 - 1,0 seconds)**

If parameters are chosen(e.g. RBC – HCT – MCV – PLT) and the **START-button** is pressed, the measuring will be started.

The volume unit will be emptied and a measurement will be carried out.

The process can be watched through the inspection window.

**The lower LED-Control shows start of the measurement.**

**The upper LED-Control shows end of the measurement.**

If the measurement is completed the results are shown on the display.

RBC 0,00   HCT 00   MCV 00   PLT 00

In case of an incorrect measurement, the instrument gives an error signal (See section Errors).

#### 4.4.2 Determination of Blank Value

Choose parameters with the **AREA-buttons** and determine the blank value of the measuring solution:

Place a cup of blank solution under the capillary and press the **START-button**.

MEASURING !

When the measuring is completed the blank value of the activated parameter will be displayed.

RBC: 0,02 (for example)

#### Normal Blank Values:

**RBC** up to 0,07

**WBC** up to 00,7

**HGB** up to 00,5

**PLT** up to 050

#### Attention!

If the indicated blank-values are not reached after a measuring with blank solution, the instrument is only partially operational!  
(see also Error-Description).

## 4.5 MEANING OF INDICATIONS

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During the measuring the display shows and informs.  
It shows the mode and sample number.

### 4.5.1 While single measurements

Every following count the sample number will be increased by one.  
The SP-number also will be increased by one for the memory.

### 4.5.2 While measurement of sample series

It shows available memory and current storage.  
It is also a counter, which will be increased after every measuring by one.

### 4.5.3 Calibration

After you have measured with a control/standard you can calibrate the result by pushing the **SET-key**. After you have typed in the expected result confirm with the **ENTER-key**.

If no measurements are available, on the display appears



NO MEASUREMENT !

### 4.5.4 Input of the date

By pressing the **DAT-button** the date appears on the display.



DAT: 10-10-99) Time 11-11-11

With the **NUMERIC-keys** the day, the month and the year and the time can be entered and with the **ENTER-key** can be confirmed.

#### 4.5.5 Changing current setting

With the AL901 different animals or animal groups can be measured.  
With MOD-key the requested animal can be selected.

For the example “**rabbit**” has to be selected

The display shows:

3: (DOG) CAT = 4: \_

Choose the desired animal with the **MOD-key** (push several times) or enter the corresponding number with the **number keyboard** (e.g. **3** for “**rabbit**” or **5** for “**horse**” etc.).

3: (DOG) CAT = 4: 4

Confirm with the **ENTER-key** after you have found the correct adjustment.

#### 4.5.6 The printer control

The different print options are reported to the printer control.

**SINGLE MEASUREMENT**

If singles measurement is confirmed with the **ENTER-key**, every measurement is immediately printed after the measuring is finished.

**SERIES**

If series is confirmed with the **ENTER-key**, every measurement is saved after the measuring. They only will be printed if the Series print option is chosen.

**DELETE SERIES ? YES = START**

If **DELETE SERIES** is displayed the memory will be deleted by pressing the **START-button**.

If the **option yes** chosen, the display shows

**SERIES DELETED !**

If **PRINTING SERIES** is displayed the printout is started by pressing the **START-button**.

**PRINTING SERIES ? YES = START**

If the **option yes** is chosen, the display shows

**PRINTING SERIES !**

## 4.6 CHECK OF CALIBRATIONS

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The system is factory-calibrated with control substances. In order to check the system with a suitable control-blood it is recommended to check samples for all parameters as described in section preparation of samples.

### 4.6.1 HGB-Calibration

In order to check the function of the photometer and of the HGB-calibration place a cup with blank solution under the capillary and choose HGB-range only.

HGB    --,-

Push the **START-button** and measure the **blank solution**.

HGB    0,0

Now, measure the **HGB-standard** solution.

HGB    14,5 (for example)

#### **Notice:**

If the value should deviate from the control substance, a standard calibration can be carried out as described in section calibration

#### 4.6.2 Check of WBC, HGB-Calibration

In order to check the **white cell calibration**, select the **WBC/HGB-range** with **AREA-button**.

WBC 0,00 HGB 0.0

Place a cup of blank solution under the capillary and start the determination of the blank value by pressing the **START-button**.

WBC 4,2 HGB 13.5

When the blank value is acceptable, place the prepared RBC-solution under the capillary and determine the correspondent value.

**Notice:**

Should the values differ from the required ones of your control-list, carry out a standard calibration as described in section **calibration**.

#### 4.6.3 Check of RBC, MCV, PLT-Calibration

In order to check the **red cell-calibration**, select the **RBC-range** with **AREA-button**.

RBC 0,00 MCV 00 HCT 0 PLT 000

Place a cup of blank solution under the capillary and start the determination of the blank value by pressing the **START-button**.

When the blank value is acceptable, place the prepared RBC-solution under the capillary and determine the correspondent value.

RBC 4,52 MCV 88 HCT 37 PLT 223

**Notice:**

Should the values differ from the required ones, carry out a standard calibration as described in section **calibration**.

## 5 THE PRINT OPTION

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With the **AL901** the measured results can be printed with a graphic printer. On the top of the printout the date and current memory number will be shown.

Furthermore the measured results, the calculated parameters, the measuring units, the normal ranges and the distribution-curves are shown on the printout.

Shall the calculated parameters **MCH** and **MCHC** be printed, then the **RBC-results** and the **HGB-results** must be determined before in order to calculate.

The two results must be assigned by a memory number. During series measurement it is possible to direct up to 30 numbers.

### Notice

**If the animal will be changed the memory will assign the wrong value.**

### 5.1 The single print

Choose with the **DAT-button** single-print-mode.



SINGLE MEASUREMENT


Push the **START-button** to use single measuring.

After any carried out measuring the measured results, its calculated parameters and the corresponding distribution curves will be printed.

While measuring the display additionally shows which print mode has been selected.

### 5.2 Delete memory

By pressing the **DAT-button** the display appears.



DELETE SERIES ? YES = START

If **DELETE SERIES** is displayed the memory will be deleted by pressing the **START-button**.

If the **option yes** is chosen, the display shows



SERIES DELETED !

### 5.3 The series print

For **series measuring** the **DAT-button** must be pushed several times.

**SERIES**

If series is confirmed with the **ENTER-key**, every measurement is saved after the measuring.

Only by assignment with the **SP-number** it is possible to print the measured values of a test with all results completely.

The serial number will be increased after every measuring automatically.

If the measuring channel is changed, the measuring of an available series number must be assigned.

#### Work example:

The secondary dilution must always first be processed at the routine work.

Choose the measuring range of **RBC** and **PLT**.

**RBC 0.00 HCT 0 MCV 0 PLT 0**

For the **sample** use a **defined number**.

**SP: 1**

After the sample 10 the **SP-number** shows

**SP: 10**

Now the primary dilution can be measured. (you have to set back to No. 1 in order to assign the correct dilution to the sample-No. measured before)

Choose measuring range **WBC** and **HGB**.

**WBC 0.00 HGB 0.0**

Now the samples will be handled in the same way as the secondary dilution.

Start with **SP-number 1**.

**SP: 1**

After the sample 10 is measured the **SP-number** shows

**SP: 10**

Shall the results be printed out, select with the **DAT-button**

**PRINTING SERIES ? YES = START**

and push **START-button** to confirm.

The complete results of all samples will be printed.

All results, calculated parameter and distribution curves remain in the memory until it is deleted or overwritten.

## 5.4 THE PROCESSING OF THE SAMPLE

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The **AL901** counts the determined particle absolutely. Before the sample is ready for measurement it must be prepared in an exact dilution by a diluter or a pipette. It is possible to form the dilution variably.

We have fixed a dilution of 1: 400 and 1: 42500 in order to meet with the requirements of the electronic settings of the instrument.

### **Production of the primary-dilution**

Dilute and mix 20 µl **EDTA-blood** with 8.0 ml Celloton

**Measuring solution = WBC / HGB**

### **Production of the secondary-dilution**

Dilute and mix 75 µl **primary-dilution out of the first dilution** with 8.0 ml Celloton

**Measuring solution = RBC / PLT**

After producing the **secondary-dilution** added **5-7 drop lysing-solution** to the **primary-dilution** and mix it.

**Note:** The dilutions have to be produced in particle free Cellcups.

Place the sample (secondary dilution) under the measuring capillary and select the measuring range.

RBC 0.00 HCT 0 MCV 0 THR 0

Push **START-button**.

During routine measurement of series we recommend to work off the secondary dilution first and then all first dilutions (e.g. 10 x second dilution and then 10 x first dilution in order to avoid a carry-over of lyse when you change from WBC/HGB to RBC/PLT).

After you have measured all RBC/PLT-dilutions you switch on WBC/HGB.

WBC 0.0 HGB 0.0

In this case you avoid changing the channels steadily.

### **Note:**

For cleaning the Diluter-tip only use a fluff-free cloths, in this case the capillary orifice will be not blocked.

**A blocked capillary can make measurement impossible or can destroy results.**

## 6 WORKING WITH THE INSTRUMENT

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### 6.1 SYSTEM-HANDLING

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The instrument is switched on by the mains switch at the backside. It is immediately ready to work.

Make sure that the filling bottle (right) is full and the waste bottle (left) is empty.

After removing the cup with cleaning solution prepare a cup of Celloton and place one cup under the capillary.

Activate the test cycle by switching off all parameters. Start the instrument and check the measuring time.

**Measuring time is: 10,5 sec. + 1,5 - 1 sec.**

If the measuring time is not correct, the instrument indicates an appropriate error report. Please clear the disturbance with the recommended steps given on the display (see chapter errors).

If the measuring time is correct, press the **MEASURING-RANGE-button** until only **HGB** appears and start the measuring cycle again. Now an automatic zero-adjustment of the HGB-photometer is carried out. A check of the isotonic solution in the **RBC-area** shows that the measuring system is working correctly.

The blank value should not exceed 0,07 (RBC). If this is not the case, the cycle should be repeated with fresh isotonic solution.

### **6.1.1 Calibration of RBC, PLT and WBC**

In order to check the functions of the measuring system and the individual parameters, switch on the individual parameters with **buttons** (one after the other) and carry out a determination of the blank and standard values from the blank solution and the prepared samples.

The determined values should be compared with the values of column **semiautomatic systems** or corresponding **instrument of MDC** if indicated. The value that was measured ought to be within the acceptable range of the control-blood.

#### **Attention!**

**In case you are using various kinds of control-blood, be aware that not every Control-blood is suitable to measured with a cellcounting system, as the discriminators and analyzing criteria are set up for human blood.**

**This particularly applies to abnormal blood. Please, only use normal range of control.**

**Therefore it must be assured in every case that the control-blood corresponds to human blood and does not contain any latex particles.**

**Various control- bloods can lead to extremely different results.**

**Many types of control-blood that are offered do not correspond to human blood. The "cells" that they contain are artificial or animal cells.**

**For this reason it is important that the measured values match the human blood that is measured and not necessarily the control-blood.**

## 6.2 CALIBRATION

---

The instrument is factory-calibrated with standard solutions. However, if necessary the calibration for all parameters can be changed as follows:

### 6.2.1 Standard calibration for RBC-PLT-MPV-HCT

Press **RBC-button** on **keyboard**.  
Produce and measure **RBC-standard-solution**.

RBC 0.00    HCT 00    MCV 00    PLT 00

When the measurement is finished the display shows: (e. g.)

RBC 4.42    HCT 37    MCV 87    PLT 211

Press **SET-button**.

RBC 4.56    RATED VALUE: \_ \_ \_ \_

Type in required value in digits by **keyboard**.

RBC 4.56    RATED VALUE: 4.25 \_ \_

Confirm with **ENTER-button**.

MCV 100    RATED VALUE: \_ \_ \_ \_

Type in required value in digits by **keyboard**.

MCV 100    RATED VALUE: 90 \_ \_

Confirm with **ENTER-button**.

PLT 252    RATED VALUE: \_ \_ \_ \_

Type in required value in digits by **keyboard**.

PLT 252 RATED VALUE: 213\_\_

Confirm with **ENTER-button**.

MPV 8.0 RATED VALUE: \_ \_ \_ \_

Type in required value in digits by **keyboard**.

MPV 8.0 RATED VALUE: 7.1\_\_

Confirm with **ENTER-button**

Carry out a second measurement and check the calibrated results.

**Note:**

**MPV-value only will be given on printout. The suitable calibration values and the setting range for blood control can be found in column semiautomatic systems or corresponding instrument of MDC if indicated.**

**Attention!**

**HCT value, which was determined through a blood cell counter is not always identical with the centrifugal Hematocrit. Differences of 5% can occur due to the different measuring methods.**

## 6.2.2 Standard-Calibration for WBC and HGB

Press **WBC-button** and **HGB-button** by **keyboard**.  
Prepare and measure WBC/HGB-standard-solution.

WBC 0.0                      HGB 0,0

When the measurement is finished the display shows: (e. g.)

WBC 8.2                      HGB 12,2

Press **SET-button**.

WBC 8.2    RATED VALUE: \_ \_ \_ \_

Type in required value in digits by **keyboard**.

WBC 8.2    RATED VALUE: 7.5 \_ \_

Confirm with **ENTER-button**.

HGB 12.5    RATED VALUE: \_ \_ \_ \_

Type in required value in digits by **keyboard**.

HGB 12.5    RATED VALUE: 13.1 \_ \_

Confirm with **ENTER-button**.

Carry out a second measurement and check the calibrated results.

### **Note:**

**The suitable calibration values and the setting range for blood controls can be found in column semiautomatic systems or corresponding instrument of MDC if indicated.**

### 6.2.3 HGB- Zero/standard adjustment

The equipment is equipped with an automatic zero comparison. In principle, a zero comparison is carried out when a measured result is below the value 2.0 for HGB.

**Note:**

**The solution must be absolutely clean as otherwise the equipment is coordinated wrongly.**

Choose with **range-button** the **HGB-range** only and measure isotonic solution twice.

HGB 0,0

Produce a standard solution and measure now.

**Sample:**

HGB 12,5

The following value shall be entered now: **HGB 14.5 (e.g.)**

Press **SET-button**.

HGB 12.5 RATED VALUE: \_ \_ \_ \_

Type in required value in digits by **keyboard**.

HGB 12.5 RATED VALUE: 14.5 \_ \_

Confirm with **ENTER-button**.

If the input is wrong, push **SP/arrow-button** and type in the value again.

**Note:**

**The suitable calibration values and the setting range for blood controls can be found in column semi-automatic systems or corresponding instrument of MDC if indicated.**

## 7 The Diluter

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The instrument can be only operated with a diluter with two dilution ratios.

In the following the diluter that is usually provided with **MDC** is described briefly. For more details check description of diluter manual.

### 7.1 WORKING WITH THE DILUTER

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#### Diluter consists of the following parts:

1. Sample tip
2. Touch plate
6. Switch (Power)
7. Switch (WBC)
7. Switch (RBC)

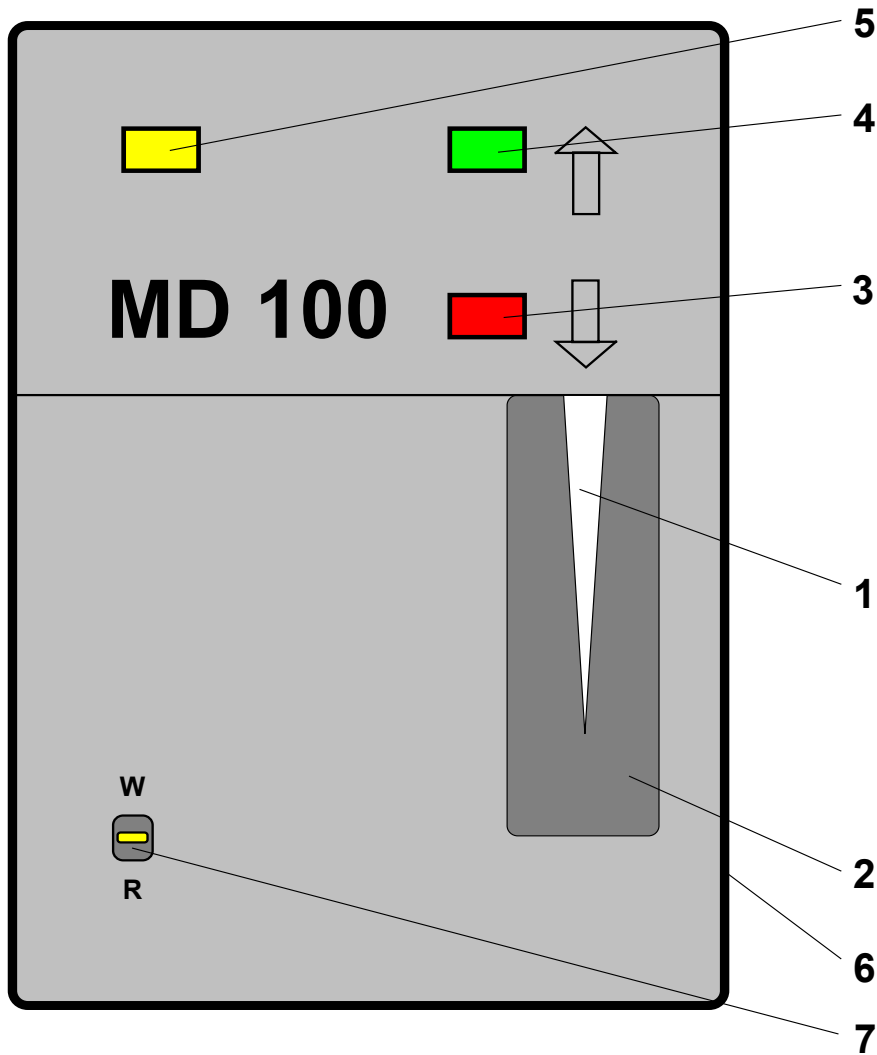
#### **Control lights:**

3. Diluting mode (red)
4. Sample aspiration (green)
5. Power (yellow)

A burning yellow light signals that the diluter is ready for sample aspiration.  
**The red light signals readiness to dilute.**

### 7.1.1 Diagram of the Diluter

Dia. 5 The Diluter and its functions (front)



#### The functional units

- |                        |                              |
|------------------------|------------------------------|
| 1. Sample tip          | 2. Touch plate               |
| 3. Diluting mode (red) | 4. Sample aspiration (green) |
| 5. Power on (yellow)   | 6. Switch (Power)            |
| 7. Switch (WBC)        | 7. Switch (RBC)              |

### 7.1.2 Diluter - Handling

Switch the dilution ratio to WBC (switch 7) and take the blood sample under the sample tube.

When the **touch plate** behind the **sample tube** is pressed, blood is sucked in and the red control light turns on.

Now the **sample tip must be cleaned** carefully.

The dilution ratio indication is on WBC and the **red dilution light signals** readiness to **dilute**.

Take measuring cup under the sample taker and **press touch plate** to dilute primary dilution (WBC) into the cup.

Switch the dilution ratio to RBC (switch 7) and the **yellow sample light** indicates readiness to **aspirate sample**.

Take cup with primary dilution under the **sample taker** and press **touch plate** so that liquid is aspirated from the middle of **the cup**.

The **red light** for dilution lights up, a new cup is held under the **sample taker** and by pressing the **touch plate** the Secondary Dilution (RBC) is **dispensed**.

#### Note:

**When diluting into sample cup avoid foaming and air bubbles. Best if cup is held in a 45 degree angle that liquid can run down the walls of the cup, otherwise you might destroy the cells!**

### 7.1.3 The Sample Sequence

While one sample is measured a new sample can already be diluted. This way the sample sequence can be increased considerably.

## **7.2 DETERMINATION OF RBC, WBC, HGB, PLT**

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### **7.2.1 Required Materials**

Apart from the measuring instrument, the following equipment is required for measuring RBC, WBC, and HGB.

- Diluting solution	Celloton	Order No. 78411
- Hemolysis reagent	Cellolyse 3	Order No. 78410
- Cleaning solution	Celloclean E	Order No. 78415
- Dilution container	Cellcups	Order No. 78664
- Stand for samples	Sample Rack	Order No. 78004
- EDTA - Tubes 4 ml		
- 20/40ul Capillaries		
- Mixer		Order No. 8240
- Diluter		Order No. 8710

For samples we recommend venous blood collected in K-EDTA tubes in order to avoid clotting/coagulation.

## **7.3 PREPARATION OF THE SAMPLE**

---

The well-mixed blood, which was prepared in the mixer, is processed as follows:

### **7.3.1 Primary-Dilution - WBC (LEUKOCYTES)**

Absorb 20 µl K-EDTA blood with the diluter.  
By pressing the touch plate again the absorbed  
20 µl blood will be transferred with 8,0 ml Celloton  
into a cup (dilution 1 : 400),  
alternatively  
mix 20 µl capillary blood with 8,0 ml  
of isotonic solution.  
(After taking the RBC-dilution add  
5-7 drops of lysing agent into WBC-dilution and mix it)

#### **7.3.1.1 Secondary-Dilution - RBC (Erythrocytes)**

Absorb suspension from the WBC-dilution  
with the diluter.  
By pressing the touch plate, 75 µl suspension  
are transferred with 8,0 ml Celloton into a cup.  
(Dilution referred to K-EDTA-Blood 1: 42.500)

### **7.3.2 Notice**

Between each dilution step, the sample-taker of the diluter must be thoroughly cleaned with a fluff-free cloth (e.g. paper towel).

Furthermore, it is recommended that the measurement-series from WBC-dilution is produced first.

Then produce the measurement-series from RBC-dilution. This can be measured directly.

Add 5-7 drops of lyses agent to the primary solution (WBC-dilution) mix it and let the hemolysis work for 5-6 seconds.

Hereafter, this solution can be measured as well.

#### **Attention !**

**If lysing reagents of other brands are used, please follow the instructions of the manufacturer.**

#### **7.3.2.1 Advice for the Working Routine**

Try to keep a regular work procedure. The same routine in processing the samples raises the exactness of your results from day to day.

The slightest traces of blood on the sample taker of the diluter influence the exactness of the prepared dilution and affects the result.

The prepared samples should be processed without delay so that there is no sedimentation of blood cells.

If possible, produce the primary-dilution for a whole rack first, i.e. 10 samples.

Before preparing the secondary-solution, the cups with the primary dilution should be swayed briefly.

A suggestion for the order of the routine measurement.

<b>FIRST</b>	RBC, HCT, MCV, PLT
<b>THEN</b>	WBC, HGB

## 7.4 COUNTING OF THROMBOCYTES

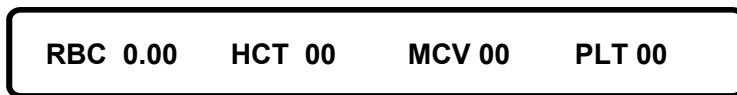
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### 7.4.1 Determination of Platelets from Whole Blood

The **HEMATOLOGY SYSTEM** is suitable for the PLT determination from whole blood parallel with the RBC-measurement through the use of a PLT-Analyzer that determines and evaluates thrombocytes simultaneously to the RBC-measurement.

**Please note however, that with the analyzer method not the same precision can be reached as with the PRP-method.**

For simultaneous PLT-measurement first activates the RBC-channel by pushing **RBC-button**, then push **T/P-button** for PLT.



#### Notice:

When PLT appears alone, and the other parameters are off, PLT is in the PRP-mode. Platelets can then only be determined by the PRP-dextran method. The instrument does not give any specification about the condition of the determined cells. Therefore, with very pathological cells or cell concentrations, a faulty determination by the computer is possible.

Yet, this is recognized by the computer and displayed in an error-report. The evaluation-error outside of the normal measuring range 150 - 400.000 thrombocytes /  $\mu\text{l}$  may be more than 20%.

In extreme cases the PRP-Dextran-method should be used.

#### Attention!

In case various control solutions are used, it has to be taken into consideration that not every control-blood is suitable to be measured with the analyzer, because the calibration and the analyzing criteria are interpreted for human blood.

This applies in particular for abnormal blood.

Therefore, it must be guaranteed that the control blood corresponds to human blood and does not contain latex particles.

Various control-bloods can show quite differing results.

The measured value should correspond not necessarily to control-blood but primarily to the human blood that is measured.

### 7.4.2 Measuring-Range

The following points are meant as a hint to remind you of the sensitivity of the measuring method and to prevent improper usage of the system and of measured values.

It is possible if a PLT-value of less than 100.000 is counted an error rate of more than 20 % can occur, caused by the dependency on RBC.

With a PLT-value of more than 350.000 a difference compared to other measuring methods can occur. A deviation of more than 30 % is possible due to dependency on RBC and because of other criteria.

Naturally, the system also determines values of platelets that are far below or above these values and are still precise.

However, keep in mind the sensitivity of the method:

**ANALYSING RANGE:** PLT = 3 - 25 fl

**NORMAL RANGE:** PLT = 2 - 35 fl

#### Attention!

**Remember that very small particles are not analyzed. In this case the result is normally marked with "L" or "R".**

### 7.4.3 Determination of Blank Values

For the exactness of the measurement it is important to use isotonic solution of high quality in order to have lowest possible blank values.

If this is not the case, results in the pathological range can be distorted or even be unusable.

Determine blank values of the solution by some measurements without blood. The blank value must be below 50. When the blank value is acceptable, blood samples can be measured.

In case of extremely low thrombocytes, the blank value - particularly when it is above 10 - has to be taken into consideration for a correct result.

#### For example:

Sample	Value	80
Solution	Blank value	-15

---

**Sample value = Measuring result 65**

## **7.5 ANALYZER ERROR INDICATIONS**

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### **7.5.1 Result marked with "I"**

**The value is normal or extremely high:**

Do not use result without control!

Check system by measuring blank solution. Then measure the sample again. If the result is marked "I" again, the platelet distribution is abnormal and the sample is not suitable for measuring with an analyzer.

**If the measured blank values are not OK:**

Replace the capillary and determine blank value. If no acceptable blank value can be reached the reason could be an instrument defect or insufficient quality of the isotonic solution.

### **7.5.2 Result marked with "L"**

The measuring criteria are set up for a normal PLT distribution.

If small number of thrombocytes are measured it is possible that the system announces "L" as the thrombocytes distribution is shifted to the left more than 30 % of the standard.

Clean the system and determine blank value. If the blank value is ok measure the sample again.

#### **Attention!**

**If the system continues to report "L", the reason can be extremely small thrombocytes.**

**A value determined in such a way should always be checked through an equivalent method.**

### **7.5.3 Result marked with "R"**

Possible reasons are very big thrombocytes or an RBC-interference that is caused by abnormally small erythrocytes that are counted as thrombocytes and thus falsify the result.

#### **Attention!**

**Always check results through an equivalent-method.**

### **7.5.4 Result marked with "M"**

This means that, although the PLT distribution is correct, the average size of thrombocytes is extremely small.

#### **Attention!**

**If in doubt always check value through an equivalent method.**

## 8 VARIOUS INFORMATION

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### 8.1 REQUIRED MATERIALS AND REAGENTS

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To operate the instrument, high quality solutions and disposable materials are required, which are guaranteed to be particle-free and always of the same quality.

When in doubt, always use the original **accessories**.

In the following, you will find product-names and order numbers as well as packing amounts of all **accessories**.

ARTICLE	NAME	USING	PACK AMOUNT
78411	Celloton	Diluting solution	2x10 l
78410	Cellolyse 3	Lysing / HGB reagent	6x15 ml
77664	Cellcup	Particle free cups	2000 pcs.
78413	Thrombocent	Thrombocytes Reagent	200 ml
78415	Celloclean <sup>E</sup>	Cleaning solution	3x500 ml

### ADDITIONAL EQUIPMENT

Dual diluter for the preparation of dilutions

## **8.2 WORKING WITH VENOUS- AND CAPILLARY-BLOOD**

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### **8.2.1 Extraction of Samples**

The quality of the available blood is of great importance. Please let us give you some advice on this.

With **Hematology Systems** the processing of venous blood and of capillary blood is possible.

### **8.2.2 Venous Extraction (EDTA-Blood)**

**Required are:**

- EDTA coated tubes
- 70% Ethanol
- Sterile cannula

After the vein is punctured, a few ml of blood should be let flown into the labeled EDTA-tube. The sealed tube should then be carefully turned over several times (swaying) to enable the anticoagulant to thoroughly dissolve and mix with the blood. Shaking and foaming has to be avoided absolutely.

#### **Advantages:**

**Easy further processing of the sample.**

**No falsification of the sample volume because of tissue fluid.**

**Stability for up to 24 hrs. in a sealed tube at room temperature.**

**Enough sample material for numerous tests.**

### 8.2.3 Capillary-Blood

**Required are:** Capillary 20  $\mu$ l  
Swabs,  
sterile lancets  
70% Ethanol  
Cellcups

It is important that before extracting capillary-blood, especially with anemic patients and patients with low skin temperature, the pad of the finger should be hyperaemicised by rubbing or warming it in warm water. Rub the pad of the finger well with Ethanol (preferably the ring finger of the left hand) and prick the finger 2-3 mm with a sterile lancet. Wipe away the first drop of blood with a swab and then take the spontaneous flowing blood to fill the capillary from end to end.

#### **Disadvantages and Sources of Error**

Squeezing and pressing of the finger after pricking causes tissue fluid to be mixed with the blood. Tissue fluid in the sample causes a volume distortion of the blood sample that will affect the measurement result.

A further effect is bad reproducibility of the measured values.

## 8.3 DILUTION-RATIOS

---

The **Hematology Instruments** work at an end-dilution ratio of

**1 : 42.500**

In order to have a higher precision and reproducibility it is recommended to use a Diluter for preparation of the samples.

### 8.3.1 Primary-Dilution: WBC, HGB

20 µl EDTA-blood to 8 ml Celloton = 1 : 400 with PLT-Analyzer

### 8.3.2 Secondary-Dilution: RBC, HCT, MCV, (PLT)

75 µl primary dilution to 8 ml Celloton = 1 : 42.500 with PLT-Analyzer

#### Note:

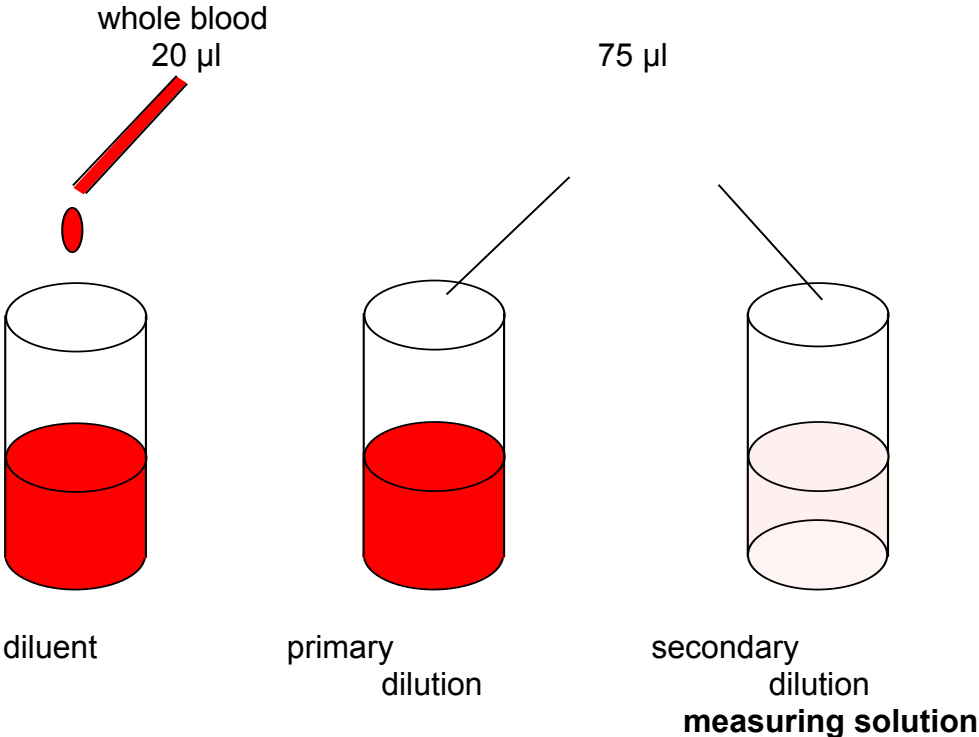
The suction probe of the diluter must be carefully freed from all external remains with a fluff-free cloth.

The primary dilution is the ready made WBC/HGB-solution after the extraction of the secondary dilution and after the addition of 5-7 drops of hemolysis reagent "Cellolyse3".

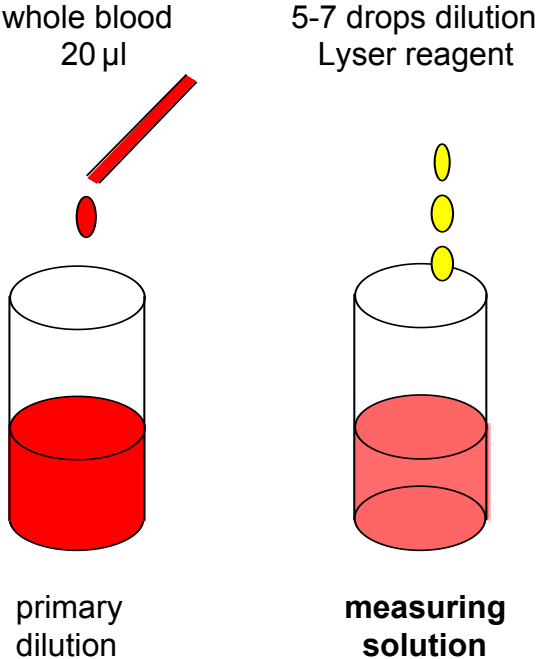
The secondary dilution is the RBC/PLT-measuring solution.

**8.3.3 Diluting Steps**

**Dilution for the counting of red blood corpuscles**



**Dilution for the counting of white blood corpuscles**



### **8.3.4 Durability of Dilutions**

The durability of dilutions depends on various factors. The times given can therefore only be approximations:

<b>Primary-Dilution</b>	: approx. 4 hrs. at room temperature
<b>Primary dilution after lysing</b>	: approx. 15 min
<b>Secondary-Dilution</b>	: approx. 15-20 min.
<b>Thrombo-Primary-Dilution</b>	: approx. 2 hrs.
<b>Thrombo-Secondary-Dilution</b>	: approx. 15-20 min.

#### **Note:**

**After standing for a longer time, the dilutions have to be carefully mixed again before continuing with the dilution process.**

**To wipe the suction-probe of the diluter, use a fluff-free one-way cloth (e.g. Kleenex), so that no cellulose-remains are carried into the sample, which often cause blockages in the capillary aperture.**

#### **Advice:**

**When changing the measuring parameter (RBC, WBC or PLT) the capillary and outer electrode must be rinsed thoroughly with a well-filled measuring cup of Celloton in order to avoid a carry-over of lyse.**

## **9 ERRORS, WHICH OFTEN OCCUR**

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Most of the disturbances in the measuring cycle and of the result are avoidable. Therefore, please accept the following advice:

**Always use fresh blood.**

**Avoid squeezing and pressing of the finger when taking capillary extractions.**

**Use tested solutions and particle-free one-way material.**

Most errors are caused by partial or complete blockage of the capillary aperture.

**Other causes are:**

**Particle polluted sample containers**

**Pollution of the reagents**

**Pollution caused by unsuitable cloths**

**Unclean aids (pipettes a.s.o.)**

Further causes are incorrect wiping of the suction probe and therefore inaccurate dilution.

Most electrical and mechanical disorders are recognized by the **Hematology System**. This is vital for the correctness of the measuring results.

**The following disturbances may occur:**

**The capillary aperture is partly or completely blocked**

**Bubbles are in the hydraulic system**

**Measuring unit is polluted**

**Instrument needs a follow-up calibration**

**Wrong dilution was measured**

## **10 MAINTENANCE**

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### **10.1 DAILY MAINTENANCE**

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The **Hematology System** will work with little disturbances, if the following steps are included into the routine:

#### **10.1.1 The System:**

Empty the waste bottle daily and refill the supply-bottle if necessary. Discard the leftovers in the supply bottle, so that leftovers of an older bottle do not pollute fresh Celloton.

#### **10.1.2 The Capillary:**

The capillary aperture must always be kept in cleaning solution (Celloclean E) in order to dissolve pollutions and proteins.

#### **10.1.3 The HGB-Cuvette:**

Place a Cup filled with cleaning solution (Celloclean E) under the capillary and start the instrument on HGB-measuring-range two to three times after yours daily working routine.

#### **Attention!**

**Take care that there is always sufficient solution under the capillary so that it cannot dry out.**

**Never use any other solutions than those, which have been mentioned, because otherwise the valve system could be damaged.**

## **10.2 REGULAR MAINTENANCE / INSPECTION**

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### **10.2.1 The Capillary**

To enable the equipment to run free of disturbances, the capillary must be kept in good condition. In the surrounding of the aperture and in the very aperture, protein deposits can occur, especially when white blood corpuscles are counted.

#### **The following guidelines are to be kept:**

**Never let the capillary dry out**

**Never let the capillary stand in a blood sample for too long.**

**Rinse the system well with “Celloton” and cleaning solution between working phases or when the cellcounter is not going to be used for some time.**

**Inspect the aperture regularly under a microscope with a 10 x enlargement for deposits or cracks.**

#### **Cleaning of the Capillary:**

Depending on the amount of samples that are measured, the capillary should be replaced from time to time. For cleaning, the capillary has to be emptied and put into fresh “Celloclean E”, so that the inside of the capillary is filled with the cleaning solution through the aperture which is thus rinsed and freed of albumin deposits.

Then rinse well with distilled water and keep the capillary stored dry.

#### **Notice:**

**For cleaning the capillary never use any cleaning agents that contain alcohol or other aggressive substances that could attack plastic materials and Plexiglas!**

**The cellcounter is equipped with one capillary. However to be safe, a spare capillary should always be at hand.**

**Before reinstalling the capillary must be well rinsed. Never let any cleaning solution enter the tube system.**

#### **Important!**

**The capillary must never be cleaned mechanically or with ultrasound. Do not use alcohol or other cleaning solutions that attack plastic materials.**

### **10.2.2 Measuring and Volume Unit**

This part has to be inspected occasionally through the inspection window at the front of the instrument. The inside walls of the volume tubes must not show any signs of stains or deposits. This can be avoided by using an appropriate cleaning reagent. In extreme cases, remove the cap and clean glass tube with a tube brush (pipe-brush).

### **10.2.3 System**

To avoid soiling of the valves and glass parts, the fluid system must be rinsed with cleaning agent during the work-series or when the cellcounter is out of action for some time.

Place a cup of cleaning solution "Celloclean E" under the capillary, push the **F-button** and rinse the system several times.

#### **Attention!**

**Never rinse the cellcounter with other fluids such as concentrated bleaching reagents.**

**Regular rinsing with cleaning solution secures of sufficient cleanliness.**

### **10.2.4 Photometer Unit**

Suck in special cleaning solution **Celloclean E** or distilled water through the HGB-probe and leave it in the cuvette over night. System has to be rinsed well with Celloton before measurement.

#### **Attention!**

**Because of the automatic zero adjustment, you must make sure of an absolutely clean solution at every determination of the blank-value.**

### **10.3 LONG-PERIOD USAGE BREAK**

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Empty the waste-bottle and fill the supply bottle with aqua-dest (distilled water). Remove and empty the capillary and place it back again. Place a Cup filled with aqua-dest. onto the holder and start the instrument by pressing the **Fill-button** two to three times. Then rinse **HGB-range** in the same way.

**Attention!**

**Never use other fluids than the solutions mentioned, otherwise the valve system may be damaged.**

When the instrument is taken back into operation after a longer time, replace aqua-dest. with isotonic-solution and reverse the process.

## 11 ERROR DESCRIPTION

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### 11.1 WHAT TO DO WHEN?

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Situation	Possible Reason	Solution
instrument does not work	loose wire or plug	check wire and plug of the instrument and mains plug
no display	mains switch out or fuse defective	turn on mains switch, check fuse, if necessary replace it (pay attention to correct value!) inform service
	electric defect	inform service
instrument out of action, display on	fuse on power board defective	replace fuse
	wires loose at PC-board or aggregate	check correct placement of wire and connect to correct plug if necessary
	loose mechanical parts or aggregate motor defective	inform service
instrument works but turns off after a short time	no vacuum system for leaks capillary placed incorrectly	check measuring check placement of capillary
	seal defective	replace seal
	filling cycle was forgotten	start filling cycle
	aperture blocked	clean capillary, if necessary replace it

<b>Situation</b>	<b>Possible Reason</b>	<b>Solution</b>
no filling cycle or turns off immediately	filling bottle empty or filling tube not in filling solution	fill bottle, sink tube to the bottom of the bottle
	filling tube bent capillary leaks	check path of tube check capillary for correct placement
	no cup with solution under capillary	check cup and solution
	mechanical defect	inform service
blank values too high	aperture blocked or polluted	replace or clean capillary
	capillary or seal broken	check seal, check capillary replace if necessary
	solution soiled Diluter soiled	replace solution clean Diluter
	bubbles in the solution	don't shake solution too much, or if the diluter tip is too thin, change
	electronic defect	inform service

<b>Situation</b>	<b>Possible Reason</b>	<b>Solution</b>
measuring value too high	blood sample defective or wrong concentration	check blood extraction system (blood tubes) check Diluter, carry out counter control with capillary blood solution if necessary
	measuring cup soiled	check cup if it is clean (i.e. not particle free)
	RBC wrong sample	use 2nd dilution
	WBC-lysis forgotten	add Lysing reagent Lysing reagent wrong or defective
	electric or mechanical defect	inform service
measuring value too low	blood sample defective or wrong measuring volume	check blood extraction system (blood tubes), check Diluter, carry out counter control with capillary blood solution if necessary

<b>Situation</b>	<b>Possible Reason</b>	<b>Solution</b>
instrument does not measure	measuring system not filled	fill system with filling cycle
	aperture blocked	replace or clean capillary
	measuring optic soiled tube	clean measuring unit
	electronic defect	inform service
instrument shows function aborted on the display	upper light barrier defect or glass tubes soiled	clean glass tubes clean system
	incorrect placement of capillary	place capillary correctly
	protective function	not necessary a mistake;
	vacuum system was activated	if it occurs repeatedly, use special cleaning cycle
	electronic or mechanical defect	inform service

<b>Situation</b>	<b>Possible Reason</b>	<b>Solution</b>
HGB shows only "00"	electronic or mechanical defect	inform service
HGB-Zero display is not reproducible	tube or suction probe leaking	check air tightness of tube, check suction probe, replace if necessary
	defect valve	inform service
HGB value too low	incorrectly calibrated	check setting
	wrong sample	prepare new sample check Diluter
	used solution defective	use new solution
	electronic or mechanical defect	inform service
HGB value too high	incorrectly calibrated	check setting
	wrong sample	produce new sample check Diluter
	lysing reagent defective	replace lysing reagent
	used solution defective	use new solution
	electronic or mechanical defect	inform service
HGB value unstable	system not airtight	check air tightness of the system
	lysing reagent defective	replace lysing reagent
	spreading between samples	mechanism does not work properly
	defective valve or electronic defect	inform service

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