

Medicine Devices



USER MANUAL ***MDC 400-700***

MDC 400-700

Semi-automated hematology analyzer for blood count

Operator manual 1.0
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Disclaimer:

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1 INTRODUCTION

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 **MDC 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.

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

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

Abbreviations and their meanings:

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

***Only MDC 700**

1.2 NORMAL VALUES

Parameter	Unit	Normal Range
RBC	10 ¹² blood c./l	4,5 - 5,5 male 4,0 - 5,0 female
WBC	10 ⁹ blood c./l	4,0 - 9,0
HCT	%	42 - 50 male 37 - 43 female
MCV*	fl 1.10 ⁻¹⁵	76 - 96
MCH*	pg g.10 ⁻¹²	27 - 32
MCHC	g/l	320 - 360
HGB	g/l	140 - 170 male 120 - 150 female

Calculation Example for Additional Parameters

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

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

*Only MDC 700

2 FUNCTIONAL UNITS

2.1 PARTS OF EQUIPMENT

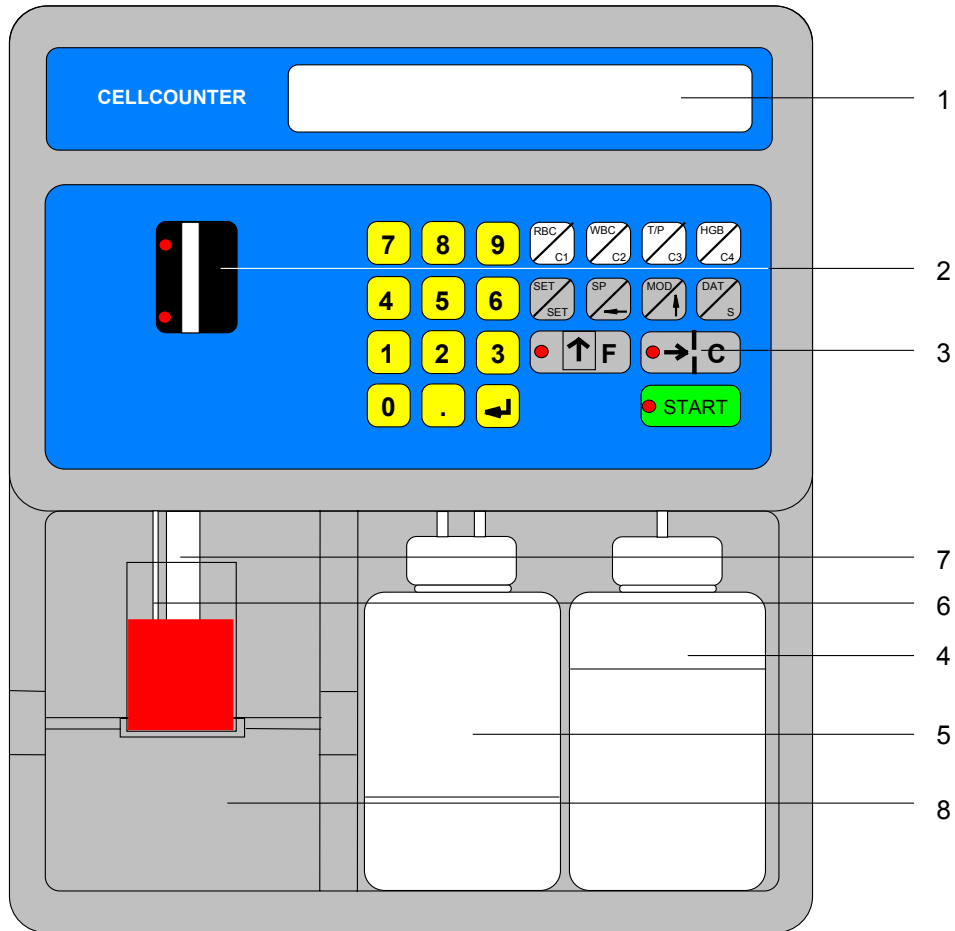
- | | | |
|--|-------------|--|
| 01. Display | - | Display for measurement/working instructions |
| 02. Inspection Window | - | Control of the measuring system surveillance |
| 03. Keyboard | - | To feed the system with figures |
| 04. Filling Bottle | - | Supply bottle for filling the measuring system |
| 05. Waste Bottle | - | Collection container for waste |
| 06. Measuring Unit
Consisting of:
Aperture-tube
Reference Electrode
HGB-Suction tube | -
-
- | Instrument transducer (capillary aperture)
Voltage feed
tube 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 - not in use
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 his functions (front)

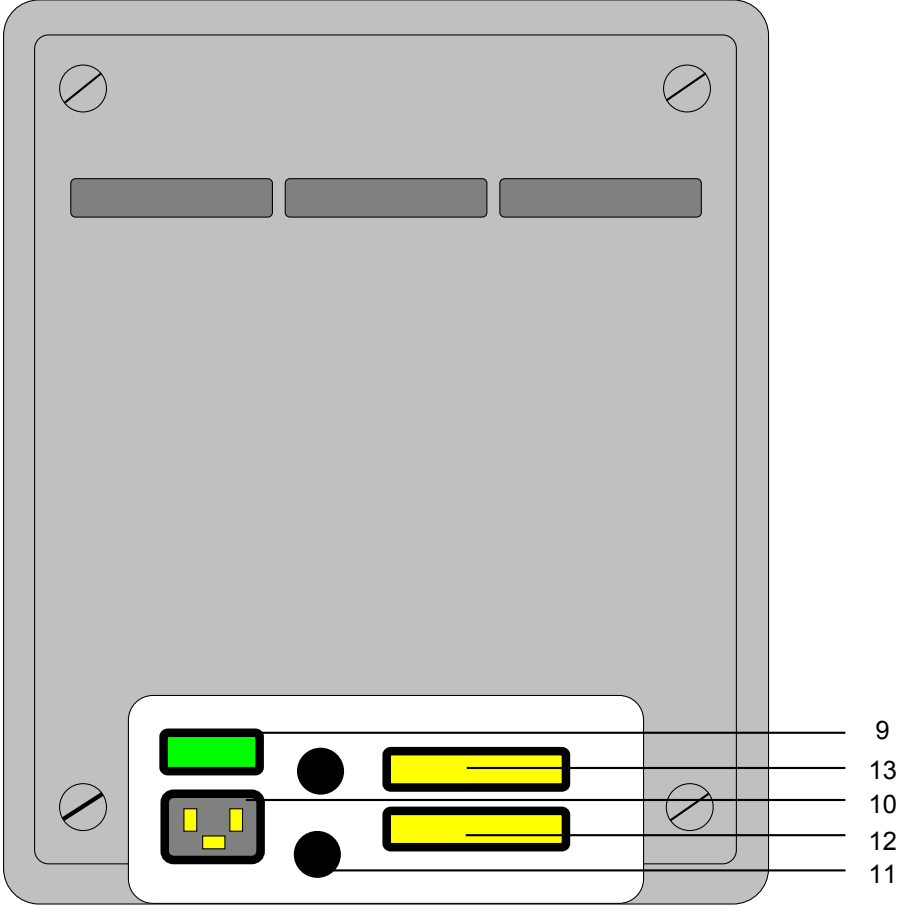


Functional units

- | | | |
|--------------------|-----------------------|-----------------------|
| 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 his functions (back)



Functional units

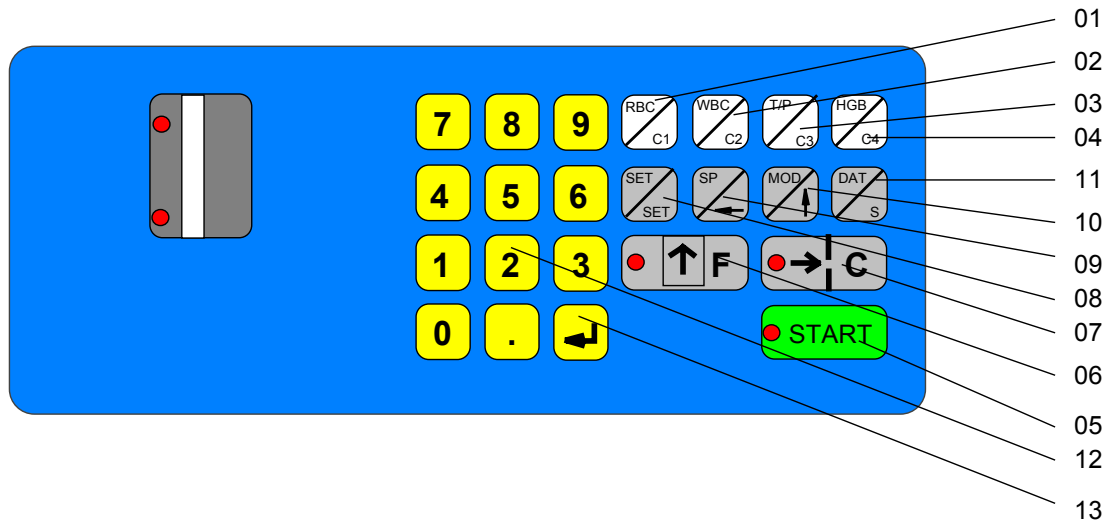
09. Mains Switch
12. Printer Port

10. Plug
13. Serial Port

11. Fuse

2.2.3 Diagram of the Equipment

Dia. 3 The Keyboard



Functional units

01. RBC-button
04. HGB-button

02. WBC-button

03. No function

05. START-button

06. FILL-button

07. CLEAN-button

08. SET-button

09. SP-button

10. MOD-button

11. DAT-button

12. NO.-button

08. ENTER-button

2.2.4 Definition of Text Indicator

SEC	-	Second indicator of stopwatch
RBC	-	Erythrocytes
WBC	-	Leukocytes
HGB	-	Hemoglobin
HTC*	-	Hematocrit
MCV*	-	Mean Corpuscular Volume
MCH	-	Mean Corpuscular Hemoglobin (average HGB weight/cell)
MCHC	-	Mean Corpuscular Hemoglobin Concentration (Average Hemoglobin concentration in %)

***Only MDC 700**

2.3 EXPLANATION OF TEXT USED ON DISPLAY

2.3.1 Equipment Displays and their Meanings

The **MDC Hematology System** is controlled by a microprocessor and has a 2 x 35- digit display.

Disturbances are shown on this 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

By using a 2-line-LCD many tests can be shown in their original length. For the sake of simplicity, only additional functions are explained.

SYSTEMTEST	-	Control of working system
TIME	-	Control of measuring time
SEC	-	Seconds
SP:	-	Sample number
RBC	-	Erythrocytes
WBC	-	Leukocytes
HGB	-	Hemoglobin
HCT*	-	Hematocrit
MCV*	-	Mean Corpuscular Volume
MCH	-	Mean Corpuscular Hemoglobin (average HGB weight/cell)
MCHC	-	Mean Corpuscular Hemoglobin Concentration (Average Hemoglobin concentration in %)

***Only MDC 700**

2.3.3 System options

PRINTING SINGLE SAMPLE ?	Printing sample from the memory
SINGLE MEASUREMENT ?	sample will not be saved
SERIES MEASUREMENT ?	Standard-setting Sample will be saved and printed
SERIES MEASURING AND PRINT ?	RBC-sample will be saved and printed with the corresponding WBC-value in the memory together with the calculated parameters.
SERIES PRINTING ?	All results in the memory will be printed
DELETE SERIES ?	The database will be deleted completely

2.3.4 System adjustments

SET DATE AND TIME ?	Set Date and Time
SET CONTRAST ?	Change contrast of LCD
SET CURVE PRINT MODE ?	Switch ON/OFF printout of curves Curves will not be saved The memory for measuring results will be increased.
SET SERIES PRINT MODE?	Switch ON/OFF serial printout Switch OFF if option Printing/Measuring will be used

Notice:

If no printer is available or switched off, with some printing options the results will be shown on the LCD.

2.3.5 Suggestions for the Elimination of Errors

ERROR: CAPILLARY BLOCKED !	Measuring time too high Push C-button
ERROR: AIR IN SYSTEM !	The volume-control has recognized air-bubbles in the system Check sample and filling bottle Push F-key
UNTERTIME: : AIR IN SYSTEM !	The volume control has detected air-bubbles in the volume unit Check sample and filling bottle Push F-key
OVERTIME: CAPILLARY BLOCKED !	The Stop-light-barrier was not reached Push C-key Eventually clean capillary
ERROR: NO MEASURING VALUES !	Measuring was interrupted Measure sample again
VOLUME ERROR: FILL SYSTEM !	The volume control has detected air-bubbles in the volume unit Check sample and filling bottle Push F-key
INFORMATION: MEMORY FULL !	Memory is full The system switches off the memory
ERROR: CLEAN CAPILLARY !	Push C-key eventually clean capillary manually

2.3.6 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

3.1 INSTALLATION

Remove the cover-lid, check if all parts are in correct position.

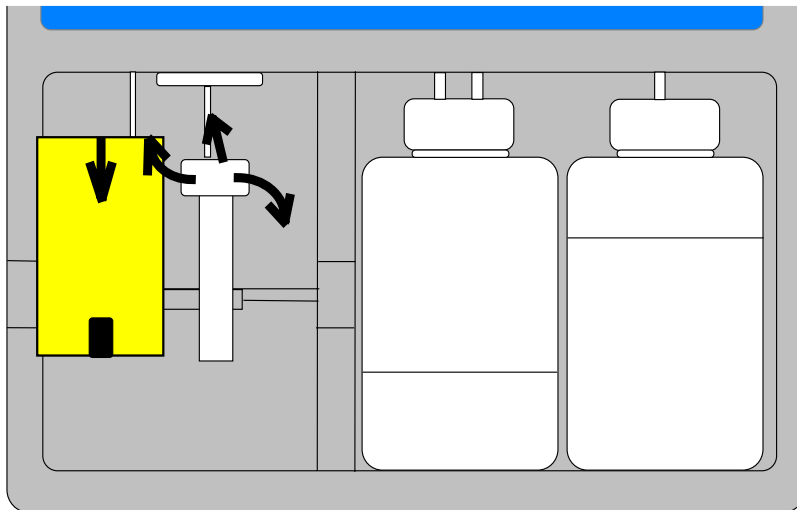
Fill supply bottle with isotonic solution, place supply tube in the provided hole and let it sink to the bottom of the bottle.

Connect 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



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

The keyboard of the MDC 400/700 has been subdivided into equipment control keys, function choice buttons, numeric keys and measuring range choice buttons.

4.1.1 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.

4.1.2 CLEAN-button

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

4.1.2.1 Measuring-area

If the capillary is blocked partially, 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.

4.1.2.2 HGB-area

A special cycle is carried out. When the instrument was not used for a longer period, it can happen that the tube system and the valve are blocked.

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.

4.1.3 The START-button

By pressing the **START-button**, the measuring cycle will be started.

If the **START-button** is pressed again **the functions then operates like a STOP-button. The measurement will be interrupted.**

4.1.4 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.

4.1.5 The Set / Set-key

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

4.1.6 The SP / ← -key

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

The memory number can be changed after every measuring.

Also it is used as a delete key.

4.1.7 The MOD / ↑ - key

By pressing the **MOD-key** the Options menu is displayed.

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

4.1.8 The ENTER-key

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

4.1.9 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.

The time, date, contrast, print and curve saving mode can be changed after pushing the **ENTER-key**.

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

4.1.10 The number-key 0-9

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

4.1.11 The DOT-key

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

Information:

If any key pushed while working the circle will be interrupted.

4.1.12 Test of Instrument

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

For all buttons with lamps, the following applies:

Button lamp on = Function on
Button lamp off = Function off

All displays are in normal writing, not in number

THIS IS THE LCD-DISPLAY

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

HEMA ANALYZER (V1.0)
DAT: 01.01.2000 TIME: 11:11:11

Push **F-button** briefly

SYSTEM IS BEING FILLED... [11:12:00]

The system is 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.

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

SP: 23 [12:31:14]
TIME 00,0 SEC

This way a measuring time control is carried out. Simultaneously a mechanical check and a check of the capillary are performed. **MDC 400 / MDC 700**

SP: 23 [12:31:14]
TIME 7,5 SEC

SP: 23 [12:31:14]
TIME 10,5 SEC

When a parameter is chosen and the **START-button** is pressed the measuring was started.

The volume unit is emptied and a measurement is 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.

When the measurement is completed the result is shown on the display.

SP: 100	[11:12:00]
RBC 0,00 MCV 90 HCT 37	

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

4.1.13 Determination of Blank Value

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

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

RBC-MODE MEASURING . . .
SERIES MEASUREMENT 2/90 SP: 100

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

SP: 100	[11:12:00]
RBC 0,00 MCV 90 HCT 37	

<u>Blank Value normal for:</u>	RBC up to 0,07
	WBC up to 00,7
	HGB up to 00,5

Attention!

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

4.2 THE DATE / TIME MENU

The instrument can be operated with different basic adjustments.
The most important adjustments will be shown here.

4.2.1 Set date and time

By pushing the **DAT-key** the date can be shown.
With **ENTER-key** the function will be activated and confirmed.

SET DATE AND TIME ?
OPERATE OPTION = ENTER

After pushing the **ENTER-Taste** the day, month, year can be typed in
by the number-keys.

CHANGE DATE / TIME
DAT: 11.02.2000 TIME: 14:32:12

4.2.2 Set contrast

By pushing the **DAT-key** the contrast can be selected.

SET CONTRAST ?
OPERATE OPTION = ENTER

With **ENTER-key** this function can be activated and confirmed.

CHANGE CONTRAST = ARROW KEY
DISCONTINUE = ENTER

Through the arrow-keys the intensity of the display can be chosen.
By pushing the **ENTER-key** you leave this function.
The adjustment will be saved and used when the system will be started again.

4.2.3 Save curve

By pushing the **DAT-key** the option **save curve** can be chosen.

SET CURVE PRINT MODE ?
OPERATE OPTION = ENTER

With **ENTER-key** this function will be activated.

SAVE CURVE ON=1 OFF=0
PRINTMODE: (0) _

Is this option switched off, the curves will not be saved and printed. The measuring memory will be increased from **32 to 90 samples**.

If there is a change the measuring memory will be deleted.

4.2.4 Print series

By pushing **DAT-key** the option **Serial Printout** can be switched off.

SET PRINT MODE ?
OPERATE OPTION = ENTER

By pushing **ENTER-key** the function will be activated.

PRINT ON=1 OFF=0
PRINTMODE: (1) _

As there is an automatic memory and printout during **option series** or option **measuring and printing**, the printout can be switched off.

This adjustment will be saved and also will be used if the system is switched on/off again.

4.3 The MOD-Menu

The instrument is working with an option to printout and save the measured results. For use of the instrument a printer is not necessary.

The system can be operated in direct/memory or in memory/printing mode

All measured and saved results can be printed in series or single.

The parameters MCH and MCHC only can be shown in connection with the corresponding HGB and RBC-results.

The data can be stored with the available curves and also can be printed out.

If the curves are not needed the printout of curves can be switched off. The memory then will be increased from 32 to 90 samples and the memory will be deleted.

During a measurement the display shows an information in which mode the system is working.

4.3.1 Working with a printer

A selection can be made with the **MOD-key**.

SP: = Memory No. which automatically will be increased by one however with **SP-key** it can be corrected individually.

After switching on the instrument it is working in the serial mode.

4.3.1.1 Printing sample from memory

A stored value can be selected by the **SP-number** and printed or displayed.
Press **MOD-key**, choose the desired option and confirm with **ENTER-key**.

PRINTING SINGLE SAMPLE ?
OPERATE OPTION = ENTER

Confirm printing single sample with the **ENTER-key**.

SET SAMPLE NUMBER !
SP: (1/56) 1 _ _ _

Choose the stored measuring value with the sample number.
Now the measuring value is displayed and printed if the printer is switched on.

RBC 4,05 MCV 90 HCT 37
WBC 4,0 HGB 12.5 MCH 30 MCHC 35

4.3.1.2 Single measurement

A measuring will be carried out and the measured results can be shown and with the printer it can be printed out, however the **data will not be saved**.

During measurement the printing mode, saving mode, the total memory amount and the sample number will be shown.

If you have chosen several repeated measurements, the mean value will be calculated from the measured results.

Press **MOD-key**, choose the desired option and confirm with **ENTER-key**.

```
SINGLE MEASUREMENT ?  
OPERATE OPTION = ENTER
```

If singles measurement is confirmed with the **ENTER-key**, every measurement is immediately printed after the measuring. The result will not be saved.

```
RBC-MODE MEASURING . . .  
SERIES MEASUREMENT  2/90  SP: 100
```

After the measuring the result is displayed.

```
SP: 1 [11:12:00]  
RBC 4,05  MCV 90  HCT 37
```

4.3.1.3 Series measurement

The serial measurement will be activated in general if the system is switched on. After the measurement the measured result will be **displayed** and **saved**. If the option printing is switched on, the result will be printed out. During the measurement the printing mode, memory number, total number of memory and the sample number are shown.

Press **MOD-key**, choose the desired option and confirm with **ENTER-key**.

```
SERIES MEASUREMENT ?  
OPERATE OPTION = ENTER
```

If **SERIES** measurement is confirmed with the **ENTER-key**, every measurement is immediately printed and saved after the measuring.

```
RBC-MODE MEASURING . . .  
SERIES MEASUREMENT  2/90  SP: 100
```

After the measuring the result is displayed.

```
SP: 1 [11:12:00]  
RBC 4,05  MCV 90  HCT 37
```

If the printout is not finished, the print option can be turned off in the **DAT-menu**.

4.3.1.4 Printing and measuring Series

After measuring the result will be shown on the display and it will be saved.
If there might be a result with the same sample number in the memory it will be overwritten.

The results of the area which is not active will be saved – therefore the complete data of the RBC and WBC/HGB measurement can be found with the sample number and will be shown on the display. MCH & MCHC also will be shown and the results can be printed out completely (provided the printer is switched on).

**In order to work with this mode, first the memory should be deleted.
Then the RBC – or WBC-parameters have to be measured in the series mode (printing option is switched off).**

To avoid a wrong combination of data, the sample number will be set to No. 1 if the measuring area will be changed. If the suggested Number should not be used, type in the desired number.

Measure a series.

```
RBC-MODE MEASURING . . .  
SERIES MEASUREMENT  2/90  SP: 100
```

Press MOD-key, choose the option series printing and measuring and confirm with ENTER-key.

```
SERIES MEASURING AND PRINT ?  
OPERATE OPTION = ENTER
```

Change the measurement range, type in the sample number and start the desired measuring.

```
WBC/HGB-MODE MEASURING . . .  
SERIES MEASUREMENT  2/90  SP: 100
```

The result will be saved after measuring and will be assigned to the already existing result . Then it will be shown and printed out.

```
RBC 4,05  MCV  90  HCT  37  
WBC  4,0  HGB 12.5  MCH  30  MCHC 35
```

Note! eventual existing data will be overwritten by the new data.

4.3.1.5 Printing series

It is possible to print out the existing data from the memory completely.
Later the saved data also can be printed out.

Press **MOD-key**, choose the desired option and confirm with **ENTER-key**.

SERIES PRINTING ?
OPERATE OPTION = ENTER

If **series print** is confirmed with **ENTER-key**, every available data will be printed.

PRINTING SERIES !

4.3.1.6 Delete Series

To avoid a mix-up of old and new measuring data, the saved data has to be deleted before the new measuring series will be started.

This will be especially recommended if the option **measuring/printing** was chosen.

Press **MOD-key**, choose the desired option and confirm with **ENTER-key**.

DELETE SERIES ?
OPERATE OPTION = ENTER

On the display will be confirmed that the memory was deleted.

DELETE SERIES !
SERIES DELETED !

4.4 CHECK OF CALIBRATIONS

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.

4.4.1 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.

**PRODUCE WBC/HGB-SAMPLE AND
MEASURE WITH STARTBUTTON . . . SP:(1)**

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

**SP: 1 [11:22:00]
WBC 0,05 HGB 0,0**

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

**SP: 1 [11:23:00]
WBC 7,5 HGB 13,5**

Notice:

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

4.4.2 Check of RBC, MCV-Calibration (only MDC 700)

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

**PRODUCE RBC-SAMPLE AND
MEASURE WITH STARTBUTTON . . . SP:(1)**

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.

**SP: 1 [11:12:00]
RBC 4,05 MCV 90 HCT 37**

Notice:

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

4.5 CALIBRATION

To change the calibration, measure a control-blood in the corresponding measuring range and select the option **calibration** with **SET-key**.

If you try to change a result which was not measured before, the information **not measured** will appear on the display.

If this option was activated by mistake, it can be interrupted with **ENTER-key**.

The measuring results only should be changed in normal range.

4.5.1 Important Information for Calibration of RBC and WBC

In order to check the functions of the measuring system and the individual parameters, switch on the individual parameters with **buttons** (one by one) 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 in 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 be measured with a cell-counting 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 any 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.

4.5.2 Standard calibration for RBC and (MCV)

Press **RBC-button** on **keyboard**.

PRODUCE RBC-SAMPLE AND
MEASURE WITH STARTBUTTON . . . SP:(1)

Produce and measure **RBC-standard-solution**.

RBC-MODE MEASURING . . .
SERIES MEASUREMENT 2/90 SP: 100

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

SP: 1 [11:12:00]
RBC 4,05 MCV 90 HCT 37

Press **SET-button**.

ADJUSTMENT RANGE 3.50 - 5.50
RBC 4.56 RATED VALUE: _ _ _ _

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

Confirm with **ENTER-key**.

After this confirmation the display shows the next parameter.

The HCT is calculated by the MCV and can be adjusted with this parameter. 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.

4.5.3 Standard calibration for WBC and HGB

Press **WBC/HGB-button** on keyboard.

PRODUCE WBC/HGB-SAMPLE AND
MEASURE WITH STARTBUTTON . . . SP:(1)

Produce and measure **WBC/HGB-standard-solution**.

WBC/HGB-MODE MEASURING . . .
SERIES MEASUREMENT 2/90 SP: 100

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

SP: 1 [11:23:00]
WBC 7,5 HGB 13,5

Press **SET-button**.

ADJUSTMENT RANGE 3.5 - 9.5
WBC 6.7 RATED VALUE: _ _ _ _

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

Confirm with **ENTER-button**.

After this confirmation the display shows the next parameter.

4.5.4 Delete Calibration

To delete the calibration and return back to the factory-calibration, switch off the instrument, push **SET-key** and keep it pressed while you switch on the system again.

Adjustment range

RBC	=	3,00	<>	5,50		HCT	=	25,0	<>	50,0
WBC	=	4,5	<>	13,0		HGB	=	11,0	<>	16,0

5 WORKING WITH THE INSTRUMENT

5.1 SYSTEM-HANDLING

The instrument can be 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.

MDC 400

Measuring time is: 7,5 sec. + 1,5 - 1 sec.

MDC 700

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.

5.1.1 The Diluter

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

In the following the diluter that is usually provided with Model 871 is described briefly. For more details check description of diluter manual.

Diluter consists of the following parts:

1. Sample tip
2. Touch plate
3. Control light out
4. Control light in
5. Control light power
6. Main switch / Prime

Control lights:

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

A burning yellow light signals that the diluter is ready for sample aspiration.

The red light signals readiness to dilute.

5.1.2 Diagram of the Diluter

Dia. 5 The Diluter and his functions (front)



The functional units

- 1. Sample tip
- 2. Touch plate
- 3. Control light out
- 4. Control light in
- 5. Control light power
- 6. Main switch / Prime

5.1.3 Diluter - Handling

Switch the dilution 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.

Now 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!

5.1.4 The Sample Sequence

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

5.2 DETERMINATION OF RBC, WBC, HGB

5.2.1 Required Materials

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

- | | | |
|---|--------------------|-----------------|
| - Diluting Solution | Celloton/Mediton | Order No. 78411 |
| - Hemolysis reagent | Cellolyze/Medilyse | Order No. 78410 |
| - Dilution Container | Cups | Order No. 78664 |
| - Stand for Samples | Sample Rack | Order No. 78004 |
| - EDTA - Tubes 4 ml or 20/40 ul Capillaries | | |
| | | |
| - Mixer | | Order No. 8240 |
| - Diluter | | Order No. 8710 |

For samples we recommend venous blood, which contains K-EDTA as blood clotting inhibitor.

5.3 PREPARATION OF THE SAMPLE

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

5.3.1 Primary-Dilution - WBC (LEUKOCYTES)

Absorb 40 µl EDTA blood with the diluter.
By pressing the touch plate it will be transferred into a cup (dilution 1 : 250),
alternatively
mix 40 µl capillary blood with 10,0 ml
of isotonic solution.
(After taking the RBC-dilution add
5-7 drops of lysing agent)

5.3.1.1 Secondary-Dilution - RBC (Erythrocytes)

Absorb suspension from the WBC-dilution
with the diluter.
By pressing the touch plate, 40 µl suspension
with 10,0 ml Celloton are transferred into a cup.
(Dilution referred to EDTA-Blood 1 : 62.500)

5.3.2 Notice

Between each dilution stage, 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 lysis agent to the primary solution mix it and let the hemolysis work for 5-60 seconds.

Hereafter, this solution can be measured as well.

Attention !

If lysing reagents of other brands are used, please follow the instructions of their manufacturers.

5.3.2.1 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 will influence the exactness of the prepared dilution.

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.

FIRST	RBC, HCT, MCV
THEN	WBC, HGB

6 VARIOUS INFORMATION

6.1 REQUIRED MATERIALS AND REAGENTS

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 names and order numbers as well as packing sizes of all **Accessories**.

ARTICLE	NAME	USING	PACK AMOUNT
78411	Celloton/Mediton	Diluting solution	2x10 l
78410	Cellolyse3/Medilyse	Lysing / HGB reagent	4x25 ml
77664	Cellcup	Particle free cups	1800 pcs.
78415	Celloclean ^E	Cleaning solution	3x500 ml

ADDITIONAL EQUIPMENT

Diluter for the preparation of dilutions

6.2 WORKING WITH VENOUS- AND CAPILLARY-BLOOD

6.2.1 Extraction of Samples

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

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

6.2.2 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 flow 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.

6.2.3 Capillary-Blood

Required are: Capillary 40 ul
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.

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.

6.3 DILUTION-RATIOS

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

1 : 62.500

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

6.3.1 Primary-Dilution: WBC, HGB

40 ul EDTA-blood to 10 ml Celloton = 1 : 250

6.3.2 Secondary-Dilution: RBC, HCT, MCV

40 ul primary dilution to 10 ml Celloton = 1 : 62.500

Note:

The suction tube 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 Cellolyze3.

The secondary dilution is the RBC-measuring solution.

6.3.4 Durability of Dilutions

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

Primary-Dilution : approx. 4 hrs. at room temperature
Secondary-Dilution : approx. 15-20 min.

Note:

After standing, the dilutions have to be carefully mixed again before continuing with the dilution process.

To wipe the suction tube 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 or WBC) the capillary and outer electrode must be rinsed thoroughly with a well-filled measuring cup of Celloton.

7 ERRORS, WHICH OFTEN OCCUR

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 tube and therefore inaccurate dilution.

Most electrical and mechanical disorders are recognized by the **MDC 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

8 MAINTENANCE

8.1 DAILY MAINTENANCE

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

8.1.1 The System:

Empty the waste bottle daily and refill the supply bottle if necessary. Discard the leftovers in the supply bottle, so that new Celloton is not polluted by leftovers of an older bottle.

8.1.2 The Capillary:

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

8.1.3 The HGB-Cuvette:

Place an 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 can not dry out.

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

8.2 REGULAR MAINTENANCE / INSPECTION

8.2.1 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 is 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.

8.2.2 Measuring and Volume Unit

This part is 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.

8.2.3 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.

Put a cup of cleaning solution 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.

8.2.4 Photometer Unit

Suck in special cleaning solution CellocleanE or distilled water through the HGB-tube 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.

8.3 LONG-PERIOD USAGE BREAK

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 an 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.

9 ERROR DESCRIPTION

9.1 WHAT TO DO WHEN?

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
	electrical 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 nec. replace it with clean capillary, possibly inform service

Situation	Possible Reason	Solution
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
	electronically defect	inform service

Situation	Possible Reason	Solution
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 i.e. not particle free	check cup for cleanliness (blank value)
	RBC wrong sample	use 2nd dilution
	WBC Lysis forgotten	add Lysing reagent Lysing reagent wrong or defective
	electrical 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

Situation	Possible Reason	Solution
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
	electronically 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
	electronically or mechanical defect	inform service

Situation	Possible Reason	Solution
HGB shows only "00"	electronically or mechanical defect	inform service
HGB-Zero display unreproducible	tube or suction tube leaking	check air tightness of tube, check suction tube, 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
	electronically 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
	electronically 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 electronically defect	inform service

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