Service Manual

Miditron (M)

Power Supply

Input Voltage	:	88-132-V (50/60 Hz) 167-264 V (50/60 Hz)
Power Consumption:		130 VA typical 160 VA maximal
Inrush Current	:	1.2 A or less (110 V) 0.6 A or less (230 V)
Fuses	:	110 V = 1.8 A slow blow 220 V = 1.0 A slow blow

Environmental Conditions

		Operating	/	Standstill
Temperature	:	15°C to 34°C		-20°C to +60°C
Rel. Humidity	:	20 % to 80 %		20 % to 95 %
Position	:	+-2°	+-10°	
Vibration	:	none	15 Hz	
Shock	:	none	5g	

Physical Conditions

Dimension : Width : 480 mm
Depth : 480 mm
Hight : 310 mm
Weight : 15 kg

Measuring Practice

Method	:	Reflections photometer
Measuring Head	:	2 Heads each with 3 LEDs
Light-wavelength	:	555 nm, 620 nm, 660 nm
Cycle-time :	12 sec	

Printer : High speed Thermol-Printer (2 inch Type)

Service Manual

Miditron (M)

1. All electrical equipment is potentially hazardous. Never remove covers without first ensuring that they are disconnected from the AC supply, unless specific maintenance instructions or repairs are being carried out by authorized RD - Mannheim personnel.

2. All test strips should be treated with caution according to those known to contain pathogenic organisms. Similarly, cleaning of components.
Miditron transport of plate and trays should be done with respect to human health.

3. The hard- and software is subject to a program of continuous evaluation and improvement.
This also concerns service program requirements.

- Precautions taken in MIDITRON ® to reduce the hazards of injury and getting wrong measurement results

1. Hazard Analysis

Possible Hazards	Potential causes	minimum requirements for safety	implemented controls to eliminate the hazard (what is done)	brief description of control (how is it done)
Issuing wrong results	Software computation error	stopping the device	supervising the EEPROM	calculation of checksums for all relevant parts of the EEPROM
				checking the writing process into the EEPROM via reread
	Hardware defect	stopping the device	movement control of each motor in each possible motion	checking by light barriers whether each motor driven part reaches the specified position with the specified amount of motor steps
	Printer error	pausing the output while the error occurs	printer supervising	control of each relevant hard-/software signal from printer
	various reasons (chem. strip vs. Hardware vs. Software)	measured results are rejected; error is marked with the internal UA strip number	checking all data received from the measuring head for plausibility	checking the measured counts for min. and max. values, checking characteristic differences between measuring head 1 and measuring head 2
	chem. strip wrong positioned	measured results are rejected; error is marked with the internal UA strip number	checking all data computed from the data received from the measuring head for plausibility	checking whether any remission measured is smaller than a global bottom level
				checking whether the remission of exposed strip fields does not differ more than a limited value between both measuring heads.
				checking whether the remission strip field and each measuring head is smaller than a specific minimum threshold measured for each
				checking whether the remission of the compensation field does not exceed a maximum threshold

Possible Hazards	Potential causes	minimum requirements for safety	implemented controls to eliminate the hazard (what is done)	brief description of control (how is it done)
	fault in the cable between measuring head and CPU	measured results are rejected; error is marked with the internal UA strip number; stopping and opening the device, if the error occurs more often	checking the incoming data of a specific field for similarity	computing a floating mean of the measuring results of the reference field of 20 test strips and comparing this against a threshold. Stopping the device takes place, when this happens more than 4 times in a while.
	erroneous calibration	special supervising of any calibration in progress	checking all data produced in the calibration cycle for plausibility	checking the necessary amplification for each LED for min. and max. values
				difference between actual calibtation results and factory implemented values is greater than one percent
				measured counts of the calibration strip are checked for min. and max. values
	wrong remission range borders	marking the printout	the printout is marked with an asterisk and advice in the operating instruction	the changing of the remission range borders is a feature the customer can use; because of this the device checks whether there is a difference between evaluated factory range borders and customer set range borders.
being injured by the motion of internal parts of the device	device not closed	stopping the movement of the tray-desk	bar sensor	interrupt signal from sensor to microprocessor
			advice in the operating instruction	see operating instruction
	touching the transportation plate while moving	stopping the movement of the transport plate	movement control of the plate-motor	supervising the steps of the respective motor
			advice in the operating instruction	see operating instruction

The installation of the Miditron involves 3 steps:

a) unpacking and installing the instrument

b) preparing the instrument for operation

c) programming the instrument for lab requirements

a) The package includes:

1. Miditron M
2. Miditron M Accessories
3. Miditron ST (optional)

(Parts list see User Manual page 3.1 ff)

The instrument should be placed on an even work surface and protected from direct sunlight.

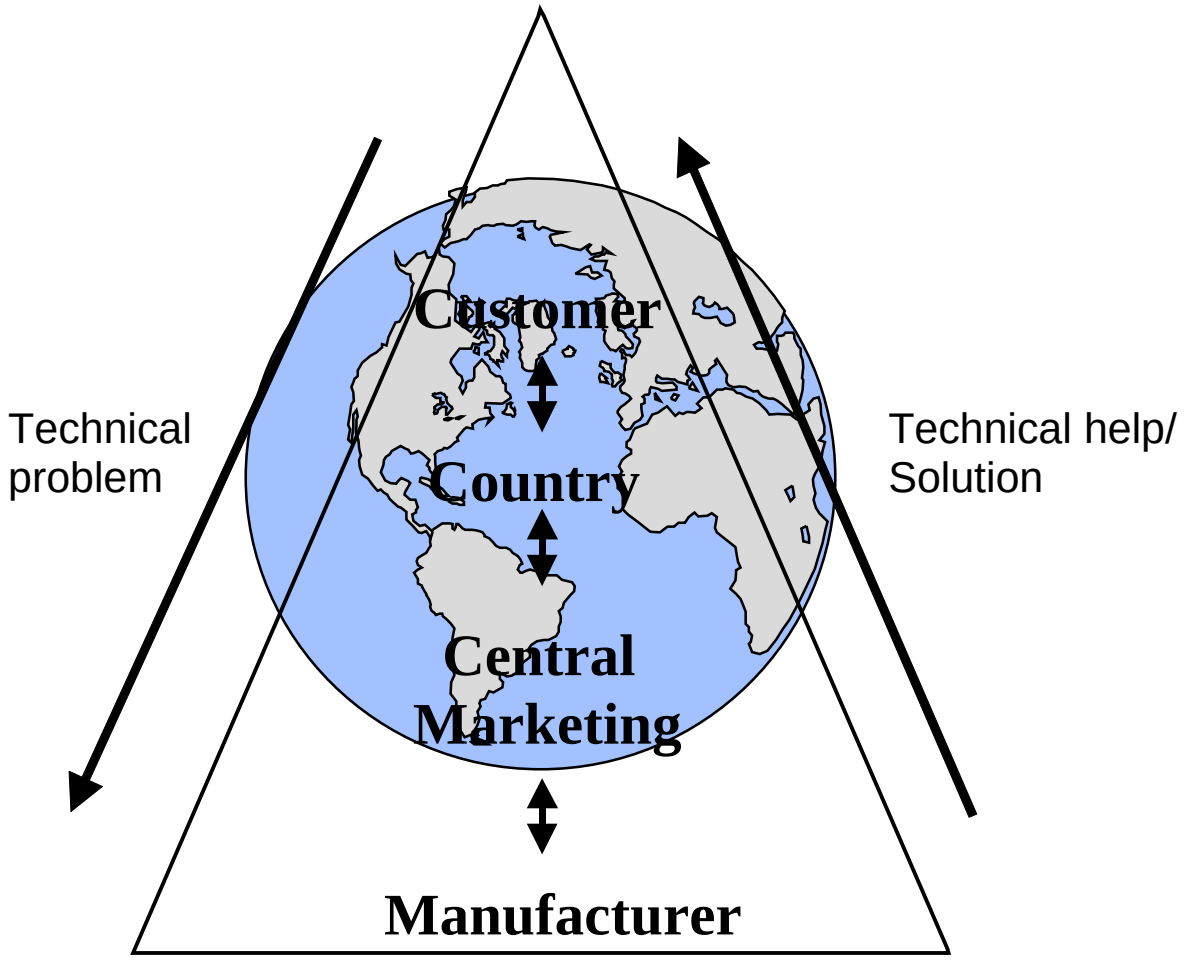
b) Please check the settings (voltage range) of the instrument (see User Manual page 3.3 ff) before switching on the instrument

c) On page 3.9 of the User Manual you find advice on how to program the instrument for specific requirements.

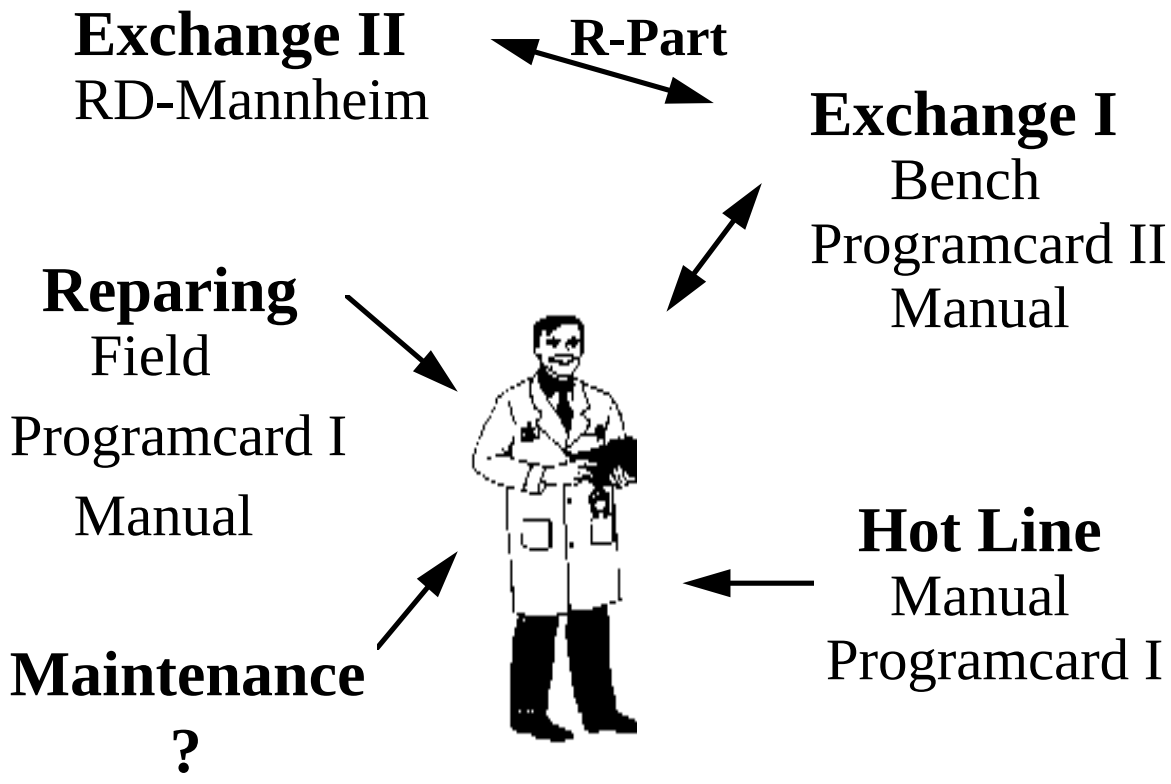
Alternatively you can use the PC-Program UDC for programming. (See chapter 5.4 Technical Manual)

RD-Service

ways of products, info and service



MIDITRON SYSTEM SERVICE PHILOSOPHY



Customer needs Help

The Miditron instrument is designed to support 3 kinds of service activities:

a)	tel. support	(trouble shooting level)
b)	field service	(board level)
c)	bench repair	(chip level)

There are different parts to support these service levels:

- Service program 1 (Chapter 5.2)
- Service program 2 (Chapter 5.3
- error messages (Chapter 6.1)
- Control LEDs to indicate supply voltages
- Low price spare parts (including mounting materials)
- In case of impossible repairing situation the measuring unit is an R-Part (broken measuring table)
- PC-program to restore individual instrument settings
- support program for adjustment (program card 2)

Information Concept

- in case of improvements concerning the instrument:
  CM sends update-pages of the service manual to the countries for replacements

- in case of new experience concerning the Miditron system:
  CM sends service news to the countries

- every year CM sends a detailed international quality report to the countries

- every year CM will organize a Miditron workshop to exchange experiences and to give updates

- during the first year after introduction the countries are requested to return any faulty parts of the Miditron to Mannheim for further examination.

RA-Procedure for Warranty Claims and Repair Handling

Warranty period for instruments and spare parts

The warranty period for instruments is **12 months** from the date of the first installation. The warranty period of RD GmbH starts at the latest **4 months** after delivery ex Mannheim.
The warranty period for spare parts is **6 months** from installation date of the part.

Shipping conditions

All shipping conditions for spare parts to the countries (RA shipment or regular spare part shipments) are **FOB.**
Emergency shipments require additional costs to be charged to the countries.

Handling of warranty claims

All claims made under the warranty for instruments and spare parts have to be handled via the return authorization procedure. The necessary RA forms are obtainable from RD GmbH (Dept. DI-RF). All other service questions or general inquiries should be addressed to the service department of the relevant product group.

Return Authorization

Please answer all the questions on the RA form with **greatest care:**

* Country Sign, Date, Instrument, Serial No., Date of Installation, Instrument or Spare Part, Part No., Date of Installation (of spare part) and Fault Description **(including error code and duty cycles).**

* Return the complete RA form together with the defective parts to RA department SI-LR **within 8 weeks from problem date to**

Roche Diagnostics MANNHEIM GMBH
Logistic Instruments
RA-Management
Dept. SI-LR
Friedrich-Ebert-Str. 100
68167 Mannheim 1

"R" Parts

* For **Miditron** please return only those parts marked with **"R"** in the spare part list.

"A" Parts

* For **Miditron,** only parts marked with **"A"** are accepted under warranty and **only parts requested from Mannheim should be returned**.
* All parts returned should be individually labeled with the corresponding RA No. and shipped together with the completed RA form.
* All accepted warranty claims will be replaced free of charge and shipped to the country immediately (in principle **FOB).**
* All defective parts not requested from Mannheim should be kept on stock for a period of 6 months (in case the manufacturer needs the part for investigation).
* All parts returned to Mannheim and not requested from Mannheim will be sent back at the expense of the countries.
* In case the manufacturer does not accept the warranty claim, the country will be charged with either the repair price or, if not available, the new price of the part.

Emergency shipment under warranty

In case of emergency, a copy of the complete RA form should be sent by FAX to the RA department SI-LR

marked with **EMERGENCY**
Fax: 621 - 759 4591

The original RA has to be sent to Mannheim, too (together with the part(s)-if necessary). A FAX does not replace the original RA form, it only speeds up the dispatch of parts.

HOTLINE MIDITRON
Phone: 0621 - 759 3227

Not accepted under warranty

Not covered by warranty are defects caused by

* Improper handling or storage
* Mechanical damage
* Chemical influence or contamination as well as damages resulting from that
* Modified parts (modification carried out without recommendation from CM)
* Parts where the fault results from instrument modification carried out without recommendation from CM
* Transport damage
* Parts not marked with an "A" in the parts list

Warranty claims for spare parts

Replacement of parts in instruments no longer under warranty

The warranty period for spare parts is **6 months** from the date of the first installation.
The RA form must state:

* Country sign
* Problem date
* Serial No. of the instrument
* ID-number of the spare part
* Installation date of the spare part
* Fault description **(including error code and number of motion counter)**

Handling of repairs

"R"-Parts
"E"-Parts

As a general rule, all instrument repairs should be carried out by the distributors.

Exchange of parts marked with "R"

Parts which are economically worth repairing are marked with "R" in the spare parts price list. For correct handling of the exchange it is absolutely necessary to return the complete RA form, giving full details of the defect. The defective parts should be labeled with the RA No. and returned together with the RA form to Mannheim.
Unless otherwise agreed, you will receive the exchange part from Mannheim immediately, and you are debited with the exchange costs.

Exchange of parts marked with "E"

All exchangeable parts are marked with "E" and handled like "R" parts.

Repair of instruments

Complete instruments are not accepted for replacement or repair unless this has been agreed with the product group responsible at RD GmbH. Before replacement or repair can take place, this validity of the request must be examined and the question of costs must be settled in a written agreement with RD GmbH.

The following service items are to be used for test and adjustments:

1.	internal reference pat	Id. No.:	1402013
2.	calibration strips	Id. No.:	1379194
3.	control strip (QC)	cancelled	
4.	Service program card I	on user program card	
5.	Service program card II	Id. No.:	1402226
6.	adjustment tools	Id. No.:	1402293

adjustment tools contain:

1 distance sensor for measuring table position
1 transparent target for measuring head position
2 adjustment strips

Specifications for Instrument Adjustment

Setting the reference position of the measuring table

Goal:

the position of the signal disk (measuring table motor control) and the position of the light barrier (measuring table reference control) must be adjusted in such a way that reference position and measuring position are identical. The reference position is the position reached after a defined downward travel from the measuring position to the light barrier. It is hence a defined position of the measuring table in the measuring module.

Execution

1. The measuring table must be spaced apart from the measuring head carrier by

   16.4 +- 0.1 mm

   This is the space from the surface of the measuring head carrier to the surface of the measuring table. To measure this distance, the center of the measuring head carrier must be brought in alignment with the two mounting points of the measuring table.

   In addition, the difference in distance between MH1 carrier and MH2 carrier (16.4) to the surface of the measuring table must not exceed 0.1 mm. This distance is measured through the hole in the measuring head carrier. If this condition is not met, the procedure must be repeated.

2. Remove the screw that holds the signal disk. Adjust the lower edge of the cut in the signal disk to the center to the light barrier. Now fix the position of the signal disk by tightening the screw.

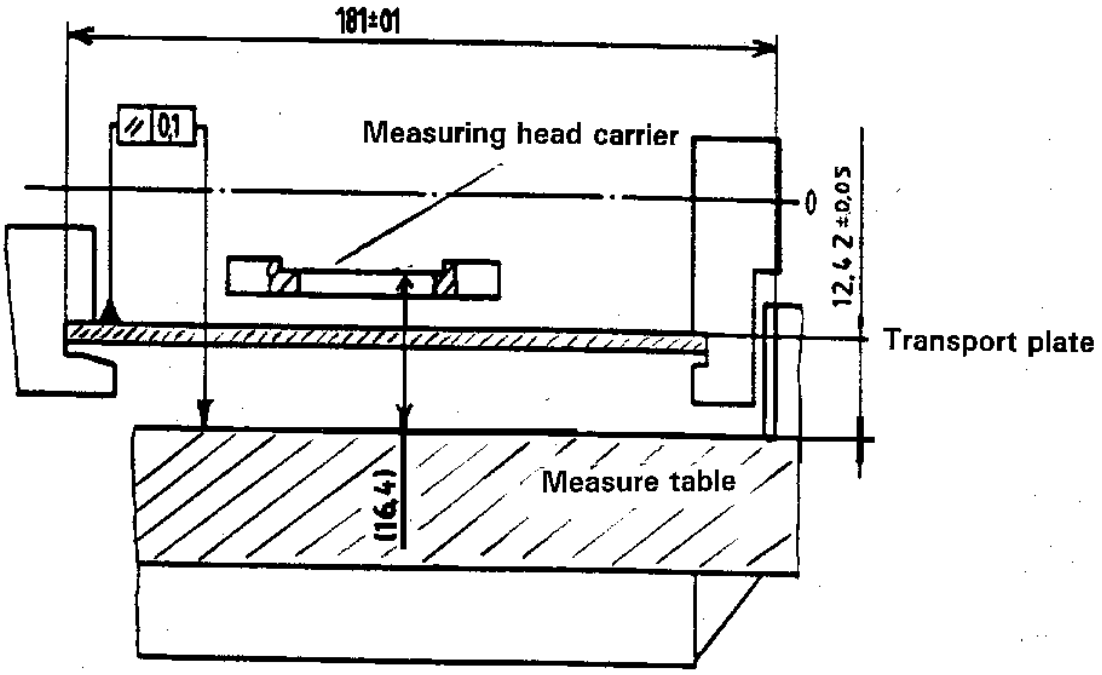
   To check this, move the measuring table down by using the service software II, move it upward again until the light barrier recognizes the signal disk position as free. Allowing for the given tolerance, the distance now found must conform with the space set as specified under item 1. If this is not the case, repeat the adjustment procedure beginning with item1.

3. Activate the step motor to move the measuring table down by 1669 steps. With the lock nut loosened, use the setscrew to adjust the position of the light barrier (measuring table reference control). Then tighten the lock nut.

   To check the position, the table is moved to the two hysteresis sides and the respective positions are measured. They must be within:

   1610 to 1728 steps

   beginning with the reference position found under item 2.



Specifications for Instrument Adjustment

Setting the Reference Position of the Transport Plate

Goal:

The position of the drive unit for the transport plate must be adjusted in such a way that the test or calibration strip comes to rest centrally (+- 0.1 mm) to the measuring heads.

Recommended way of execution

The following tools are recommended to facilitate the procedure:

One or two adjustment strips (metal strips) which have centered marks on certain positions on their test areas (e.g. a line cross).

One optical bearing which can be inserted instead of the measuring heads. The systems should be able to locate the position of an adjustment strip in measuring position up to +- 0.1 mm

1. The adjustment strip is pulled into measuring position.

2. The optical target serves to check whether or not the centered marks of the adjustment strip lie underneath the measuring position within the tolerance limit of +- 0.1 mm

3. The adjustment is carried out as follows:
   - Loosen the screws of the drive unit for the transport plate
   - Place the metal pin in the adjustment holes in the plate
   - of the drive unit of the transport plate
   - Pull the plate into the required direction and tighten the screws

Note:

Any change of the position of the drive unit for the transport plate during adjustment may result in an undefined position of the adjustment strip. It is therefore recommended to reposition the adjustment strip each time a change has occurred.

Specifications for Instrument Adjustment

Setting the Reference Position of the measuring head

Goal:

The position of the light barrier of the measuring unit must be set in such a way that measuring head carrier advances 148 steps from the reference position to the center (+- 0.1 mm) of the first test field position.

Recommended Way of Execution:

The following tools are recommended to facilitate the procedure:

One or two adjustment strips which have centered marks on the positions 1 and 11 on their test areas.

One or two optical bearing systems which can be employed instead of the measuring heads. The system should be able to locate the position of an adjustment strip in measuring position up to +- 0.1 mm.

1. The adjustment strip is pulled into measuring position

2. The measuring head support searches for the reference position as it does in routine operation. The measuring head is then advanced to the expected position of the test area. (For the first test area, this position is located at 148 steps following the reference position and for each following test area another 44 steps).

3. The optical bearing system serves to check whether or not the centered marks of the adjustment strip rest underneath the measuring position within the tolerance limit of +- 0.1 mm.
   To adjust the head, turn the adjustment screw (behind the light barrier of the measuring head) and then proceed as specified under item 2.

Note:

In routine operation, the carrier of the measuring head advances 3 steps after the light barrier is covered. The measuring head carrier then advances in and out the light barrier, this is the reference position.

Use calibration strips to check the Miditron instrument!

Activate the calibration function on program card 1, insert one of the calibration strips.

The software checks now the results of the actual calibration strip against the last stored calibration remission values and to the reference remissions.
If the differences are less than +- 1 % the last calibration values are restored.
If the differences are more than +- 1 S% a second calibration strip is required.
If the differences are now less than +- 10 % the actual calibration values are stored.
If the differences are more than +- 10 % an error message is displayed.

Calculation of remission values:

1. **$Signal_n$ = bright $counts_n$ - dark $counts_n$**

2. **$Rem_n = (Signal_n/Signal_o) * CalRem_n$**

Calculation of calibration values:

1. **$Signal_n$ = bright $counts_n$ - dark $counts_n$**

2. **$Rem_n = (Signal_n/Signal_o) * CalRem_n$**

3. **$RefRem * 0.99 <= Rem_n <= RefRem * 1.01$**
4. **if 3 yes: $Rem_n = CalRem_n$**
5. **if 3 no: second calibration strip**

6. **$RefRem * 0.90 <= Rem_n <= RefRem * 1.10$**
7. **if 6 yes: new $CalRem_n = (CalRem_n * RefRem)/Rem_n$**
8. **if 6 no: error message**

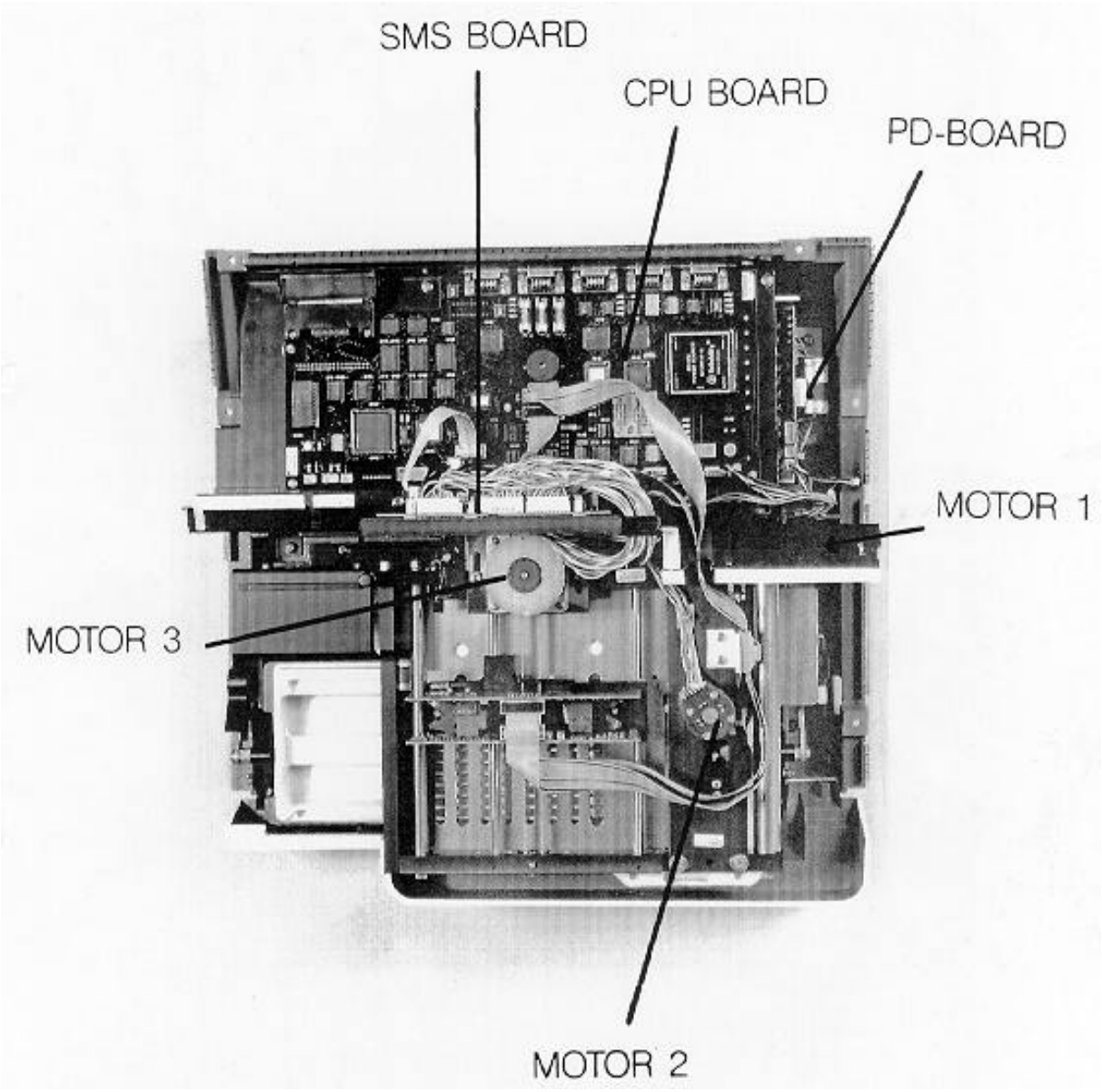
RefRem:	for green	63.9 %	
	for orange	63.0 %	
	for red	62.8 %	
	ranges of signals counts:		-40 to + 3700
	ranges of bright counts:		< 6000
	ranges of dark counts:		+500 to 2000
	ranges of signal for the internal reference pat:		2200 +- 149 counts

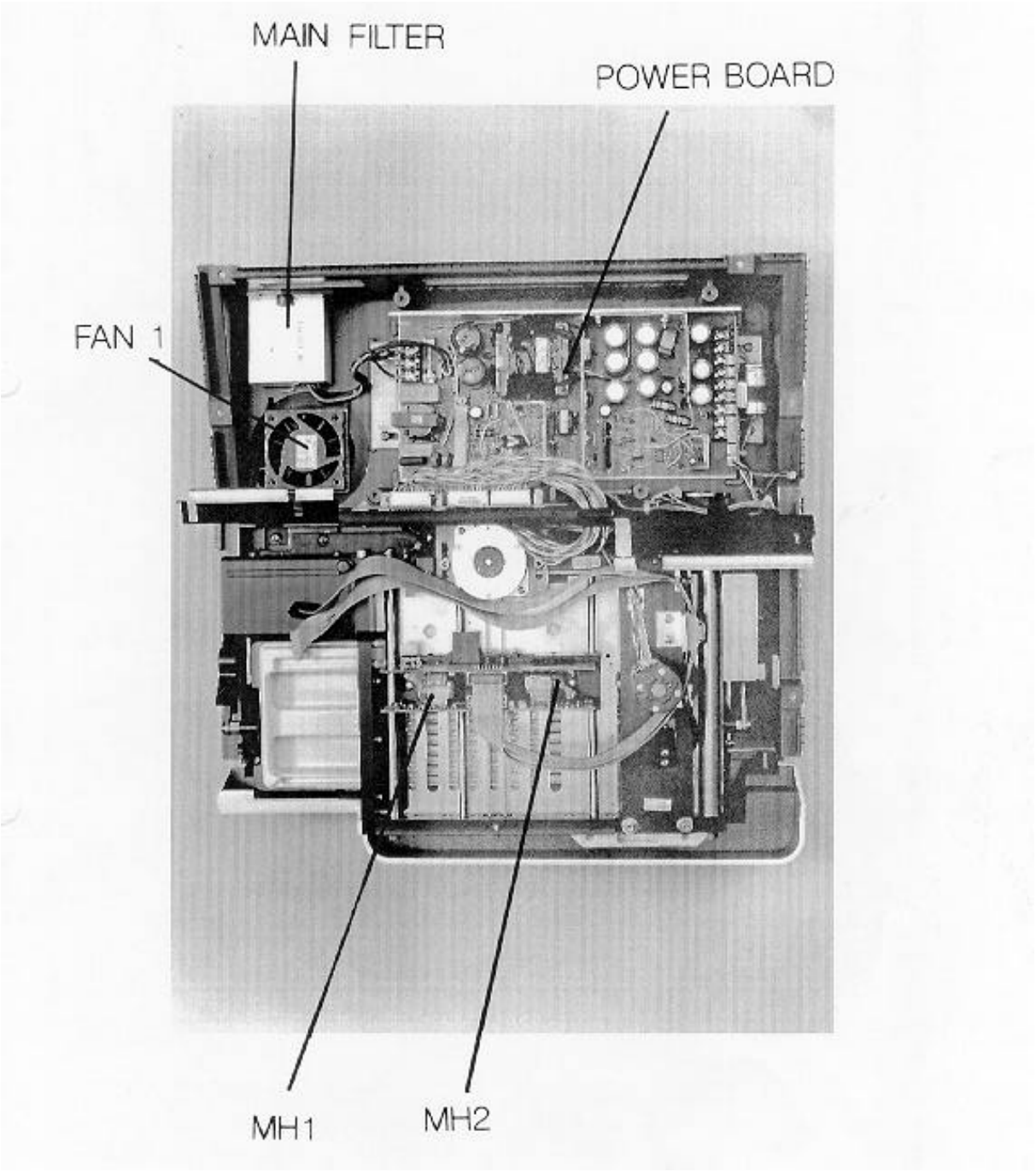
To check the Miditron system (instrument + test strip) after repair you have to use special test strips for quality control together with redestilled water.
By using the QC subroutine on program card 2 you get a printout of the QC teststrip results e.g. a calibration printout. Only those results printed in bold belong QC!

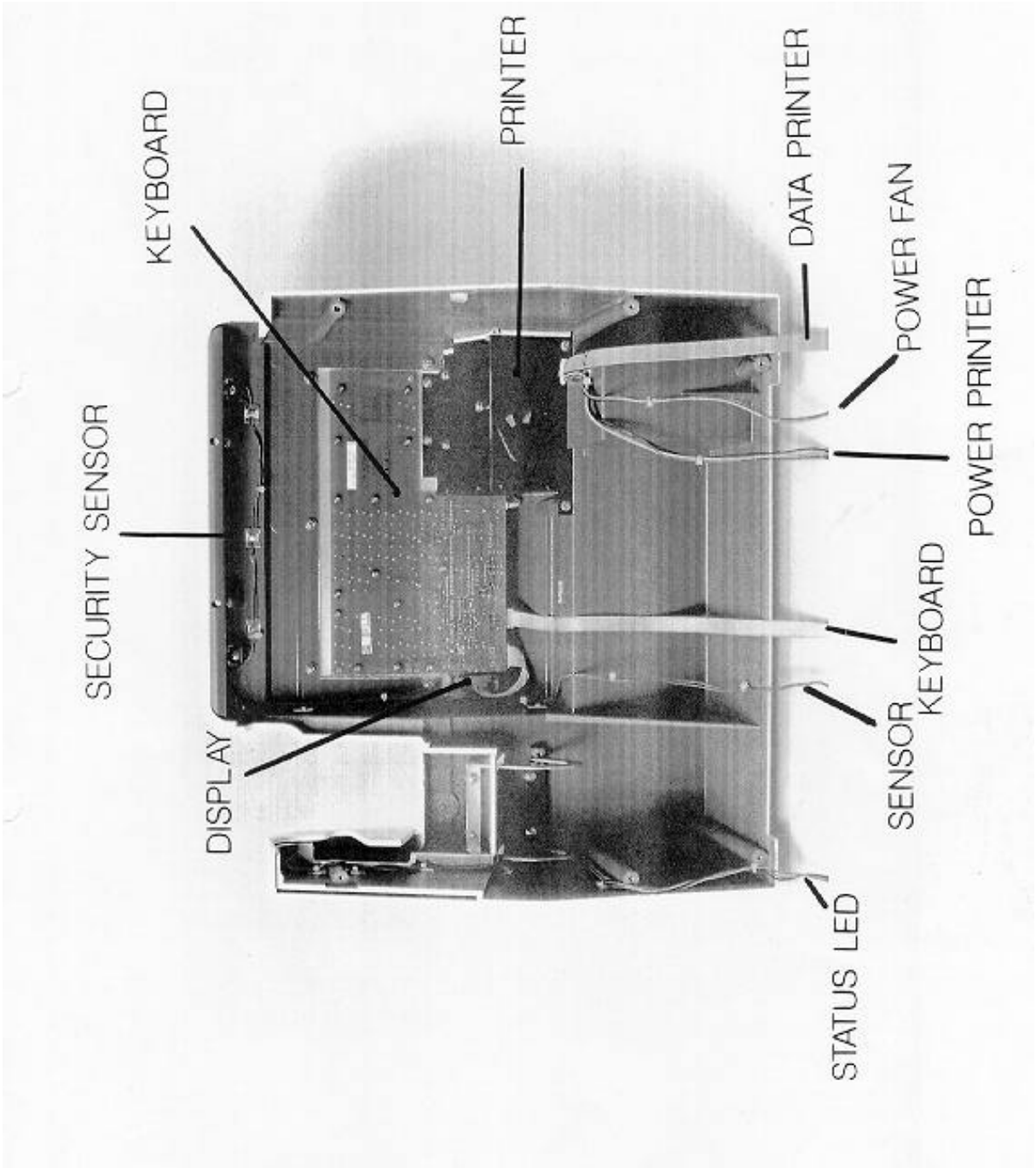
Please repeat 5 times and make sure that all bold results are between the reference range printed on the QC-strip label.

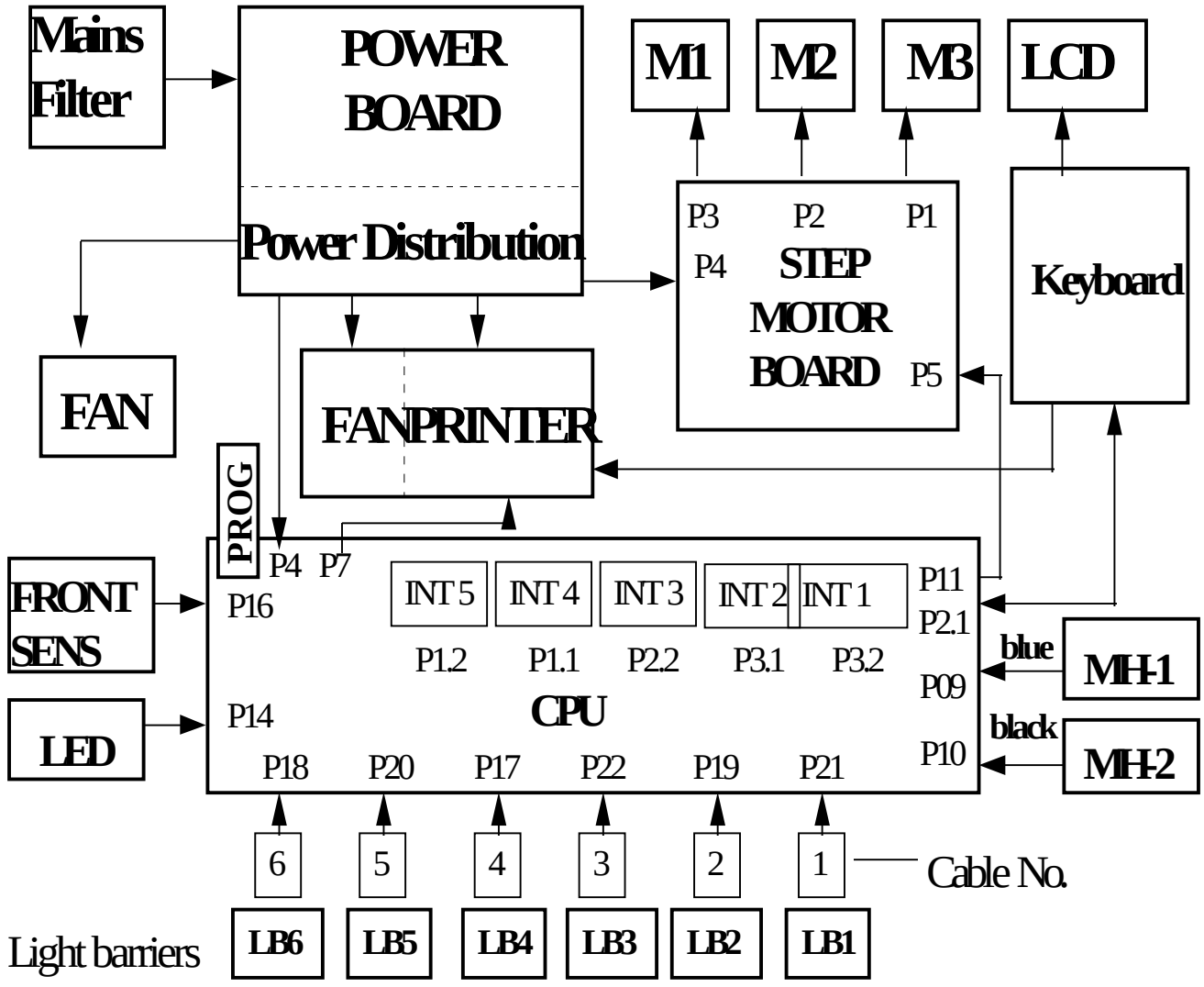
QC-strip label e.g.:

Urinalysis Check Strips		
Id. No.:		1402269
Charge No.:		282 597 80
Expiry date:		February 1993
Storing tem.:		+2 to +8°C
Test-Field	Tolerance in % of Rem	S-Max (n = 5)
A-01-G	61.5 - 75.5	3.0
B-02-R	57.5 - 71.5	2.5
A-02-G	59.5 - 74.0	2.0
A-04-G	57.5 - 74.0	3.0
B-05-G	43.0 - 59.5	3.0
A-06-G	66.0 - 80.0	2.0
A-07-G	59.5 - 73.5	2.5
A-08-G	61.0 - 75.5	3.0
B-09-G	61.0 - 75.0	2.0
Attn. Equilibrate the strips to room temperature before (20°C)		


SMS BOARD
CPU BOARD
PD-BOARD
MOTOR 1
MOTOR 3
MOTOR 2


MAIN FILTER
POWER BOARD
FAN 1
MH1
MH2

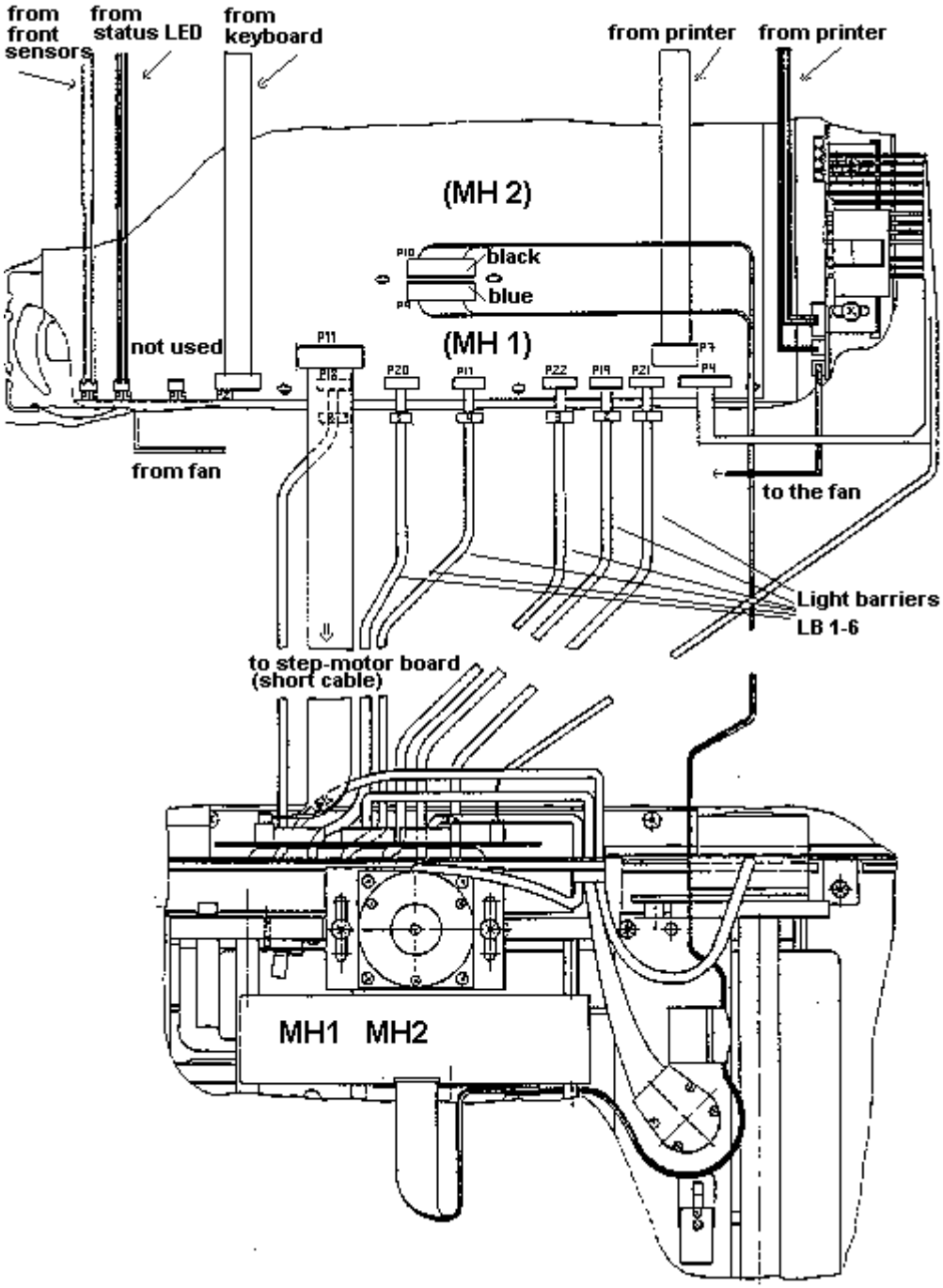

SECURITY SENSOR
KEYBOARD
PRINTER
DATA PRINTER
POWER FAN
POWER PRINTER
DISPLAY
SENSOR
KEYBOARD
STATUS LED


Mains Filter
POWER BOARD
Power Distribution
M1
M2
M3
LCD
P3
P2
P1
P4
STEP MOTOR BOARD
P5
Keyboard
FAN
FAN PRINTER
PROG
P4
P7
FRONT SENS
P16
INT 5
INT 4
INT 3
INT 2
INT 1
P11
P2.1
P1.2
P1.1
P2.2
P3.1
P3.2
blue
MH-1
P09
LED
P14
CPU
black
MH-2
P10
P18
P20
P17
P22
P19
P21
6
5
4
3
2
1
Cable No.
Light barriers
LB6
LB5
LB4
LB3
LB2
LB1

Stationary-voltage connecting-plan

MF	PD	PDB	FAN	SMB	Printer	CPU	MH 1	MH 2	Sensor 1 2 3 4 5 6 7	LED	KB	LCD
230/110 V_{AC}	X											
N	X											
SL	X											
	+5 V	X		X	X	X						
	+24 V	X		X	X							
	+12 v	X	X		X							
	-12 V					X						
	GND	X	X	X	X	X						
						+5 V	X	X	X X X X X X X	X		
						+12VA	X	X				
						-12 VA	X	X				
						+12 V					X	
						-12 V					X	
						GND	X	X	X X X X X X X	X	X	
						GND_A	X	X				
											$+5 V_A$	X
											+12 V	
											-12 V	-1 V
											GND	X

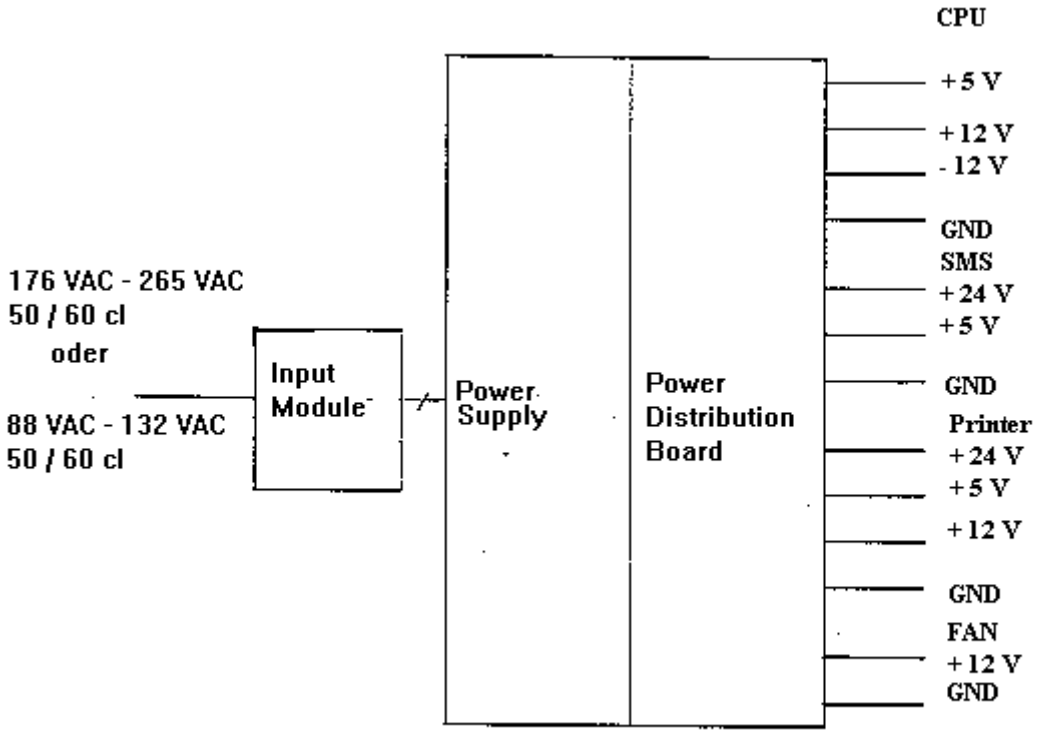
MF: Main filter PB: Power board PDB: Power distribution board
SMB: Step motor board MH 1, 2: Measuring head KB: Keyboard
LCD: Display


from front sensors
from status LED
from keyboard
from printer
from printer
(MH 2)
black
blue
not used
(MH 1)
from fan
to the fan
Light barriers LB 1-6
to step-motor board (short cable)
MH1 MH2

The power Supply unit comprises the following three individual components:

- The Power Supply input module
- The Power Supply board
- The Power distribution board

The power supply unit converts the supply voltage of 176 - 264 VAC (50-60 cl) or 88 VAC - 132 VAC (50 - 60 cl) into the following 4 direct voltages: +5 V, +24 V, +12 V, - 12 V. Via the power distribution board, these voltages are supplied to the individual components in the instrument.



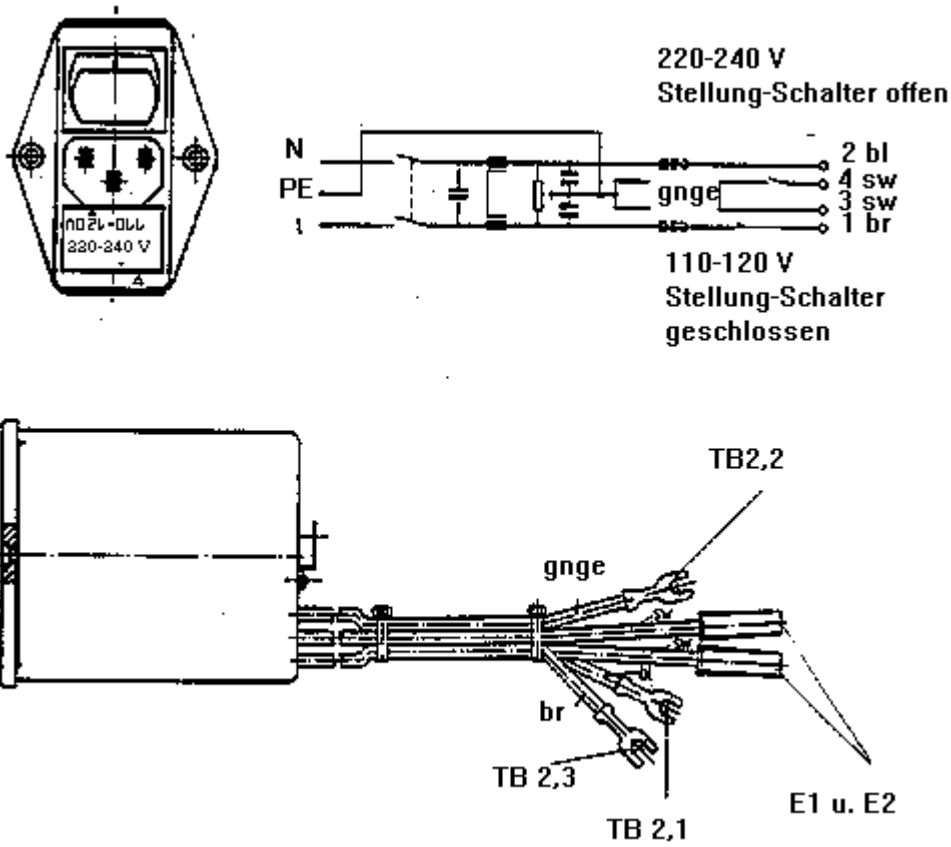
The power supply input module

A 2-pole power switch, a filter to suppress radio interference and a fuse holder for two fuses (5*20 mm) are integrated in the power supply input module.

For the two voltages ranges of the power supply use the following types of fuses:

88 to 132 VAC ≥ 1,8 A slow-blowing
174 to 264 VAC ≥ 1.0 A slow-blowing

The instrument can be set to one of these two voltage ranges by plugging in the fuse holder correspondingly.



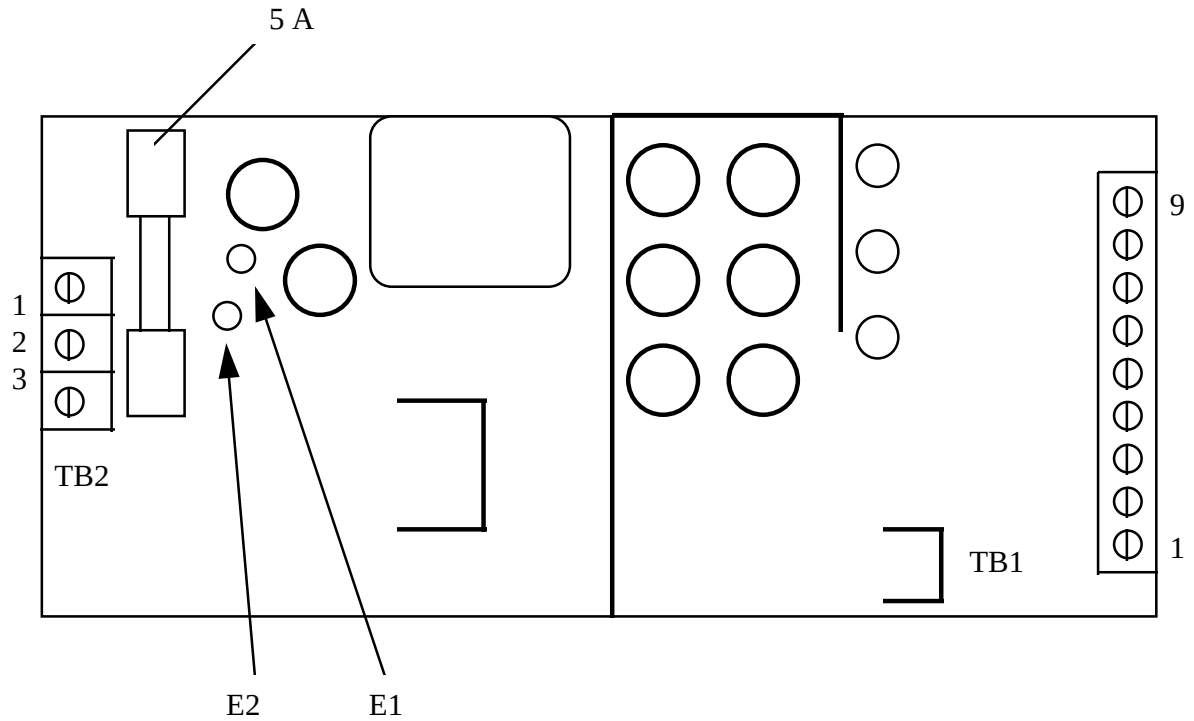
The Power Supply Board

A 3-pole TB2 terminal serves to feed the input voltage from the power supply input module. An additional fuse (5A fast-blowing) is included in the input voltage circuit to prevent short-circuiting. The power supply input module transmits the supply voltage to the two contacts JP1 and JP2 of the power supply board.

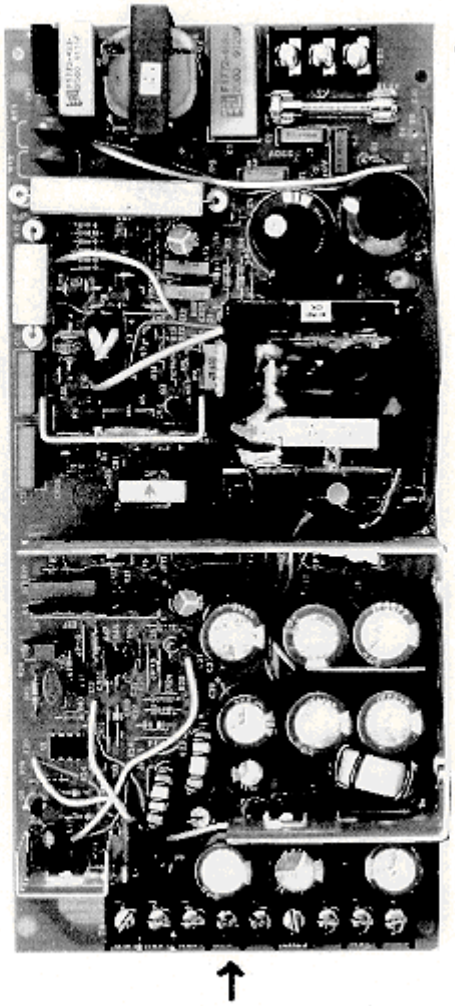
The voltages for the power distribution board are available at terminal TB1.

Pin assignment

TB2	TB1
Pin 1: AC live	Pin 1: +5 V (800mA)
Pin 2: AC ground	Pin 2: +5 V (800mA)
Pin 3: AC neutral	Pin 3: GND
	Pin 4: GND
	Pin 5: GND
	Pin 6: +24 V (410mA)
	Pin 7: +12 V (410mA)
	Pin 8: -12 V (65mA)
	Pin 9: Power Fail Detect



POWER BOARD

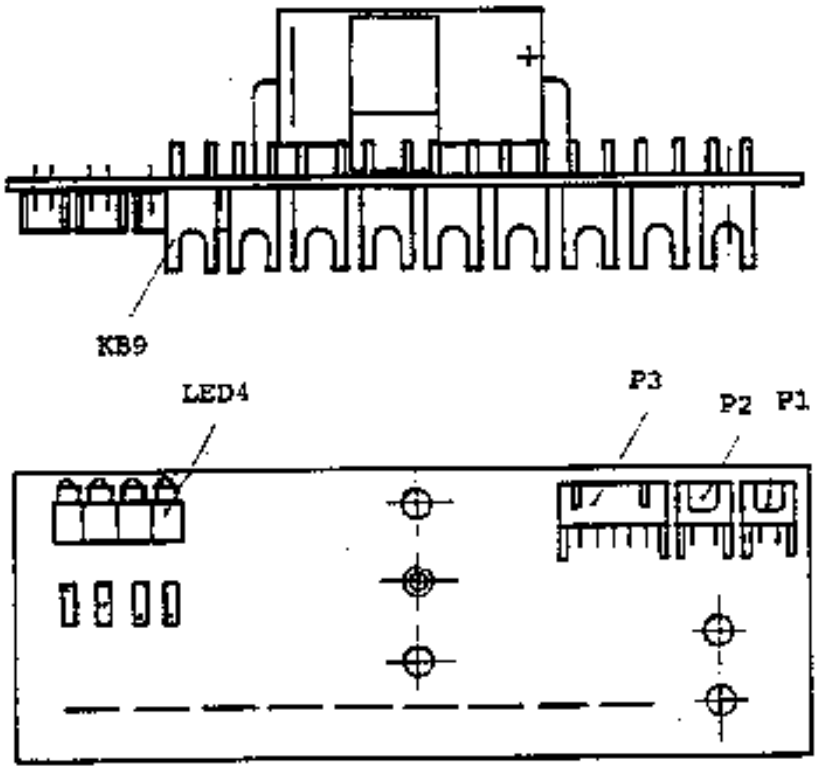


The Power Distribution Board

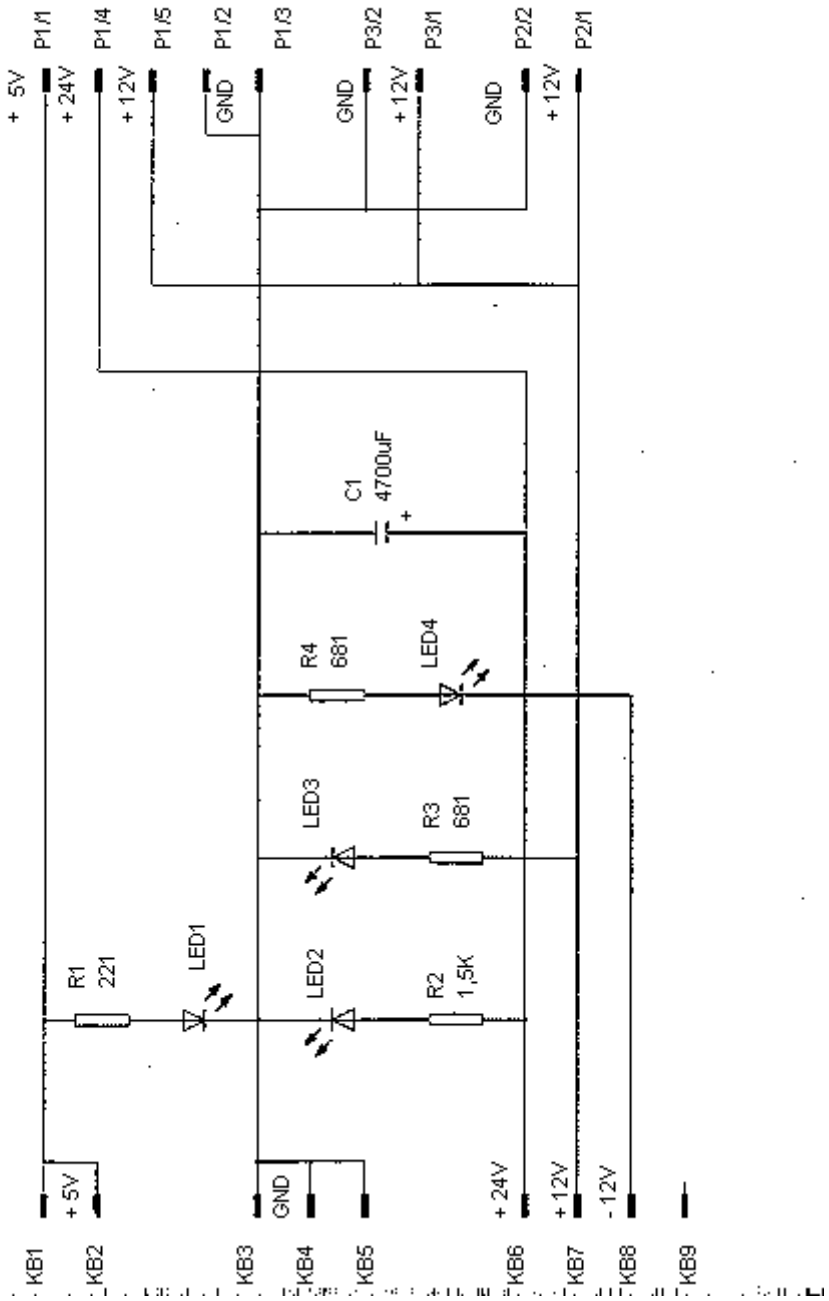
The contacts KB1 to KB9 serve to mount this board to the screw terminals TB1 of the power supply board. Power is supplied to the CPU and SMS via lines that are directly soldered to these contacts.

Power is supplied to the printer via a 5-pole plug (P3).

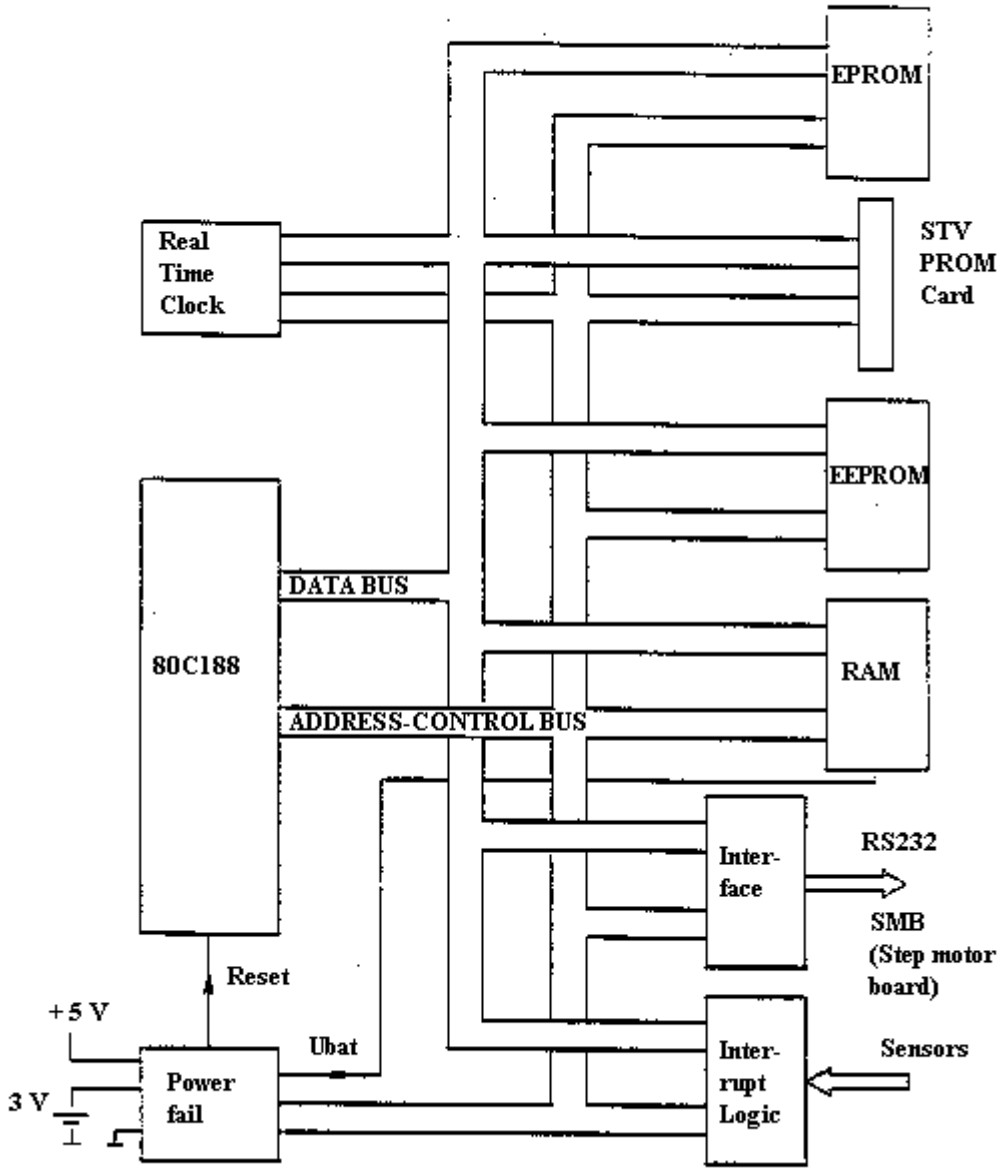
The two fans are connected via the 2-pole plugs (P1, P2). The four available supply voltages are displayed via four LEDs.



Power distribution board



Hardware Overview



The individual functional units of the CPU are listed and briefly discussed in the following block diagrams.

Microcontroller

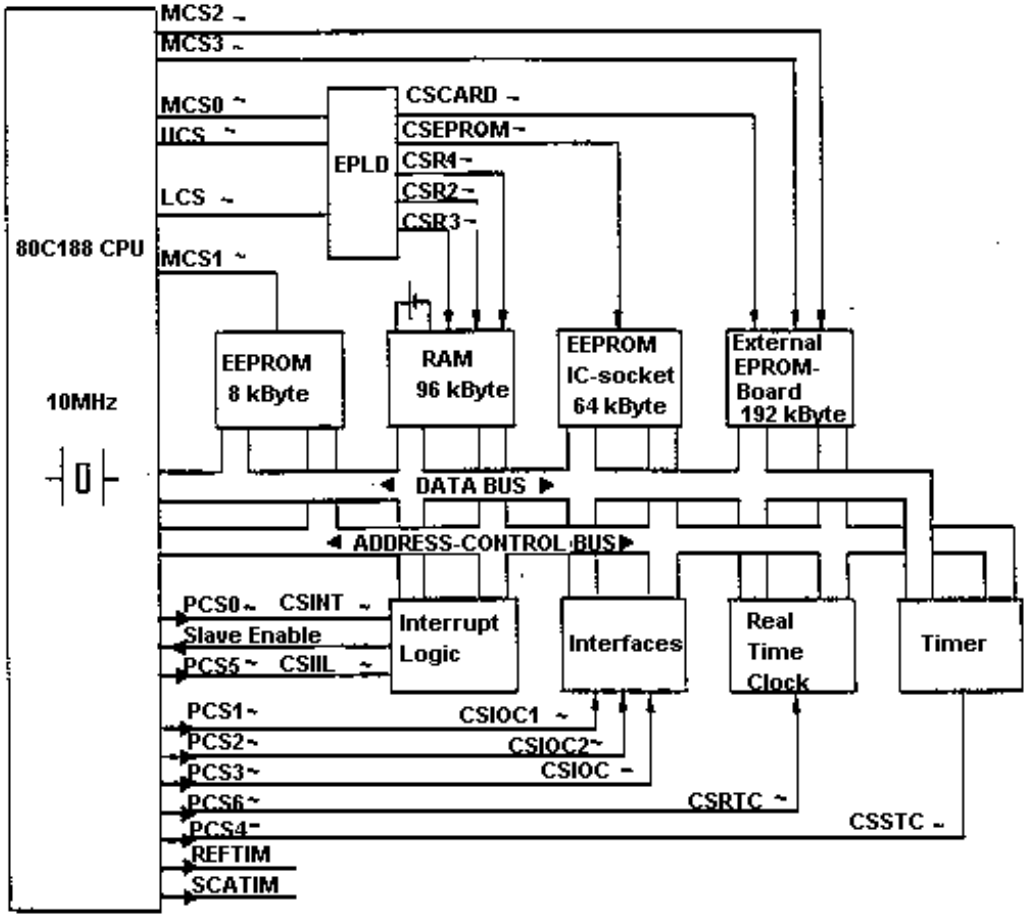
The core of the CPU is a 80C-188-microcontroller which operates on a frequency of 10 Mc. The reset of the processor is generated by MAX 691 power fail detect chip. Use button S1 to manually reset the processor.
The 80C188 has three timers which are used as follows:
Timer 1: reflex time
Timer 2: scan time
Timer 3: time basies of the operating system
The reflex time output signal controls the reflex light barrier. The scan time output signal pulses counter U33 and serves to activate the LEDs of the measuring heads.

Program Memory

The program memory is realized by means of an external memory chip EPROM (U25) with the base mounted into the board. The memory chip is a ROM cartridge with three EPROMs.

Data Memory

A base-mounted EEPROM (U 27) and three 32k Byte CMOS RAMs (U24, U30, U25) are provided for data storage. The first 32 K Byte of the CMOS RAM (25) are battery-buffered. In case of a power failure (<2.6 V), the power fail detect then switches to battery operation.


MCS2
MCS3
MCS0
UCS
LCS
MCS1
80C188 CPU
10MHz
EPLD
CSCARD
CSEPROM
CSR4
CSR2
CSR3
EEPROM 8 kByte
RAM 96 kByte
EEPROM IC-socket 64 kByte
External EPROM-Board 192 kByte
DATA BUS
ADDRESS-CONTROL-BUS
PCS0
CSINT
Slave Enable
PCS5
CSIIL
Interrupt Logic
Interfaces
Real Time Clock
Timer
PCS1
PCS2
PCS3
PCS6
PCS4
REFTIM
SCATIM
CSIOC1
CSIOC2
CSIOC
CSRTC
CSSTC

The Interfaces

A total of seven RS232 interfaces is available. Two of these are reserved for internal jobs (int. printer, keyboard) and five to connect external instruments.

One interface chip (U14, 15, 16) controls two interfaces at a time.
Internal and external printers are operated via a switchable interface.

The following fuses are provided to protect the interfaces for the sediment terminal and the barcode:

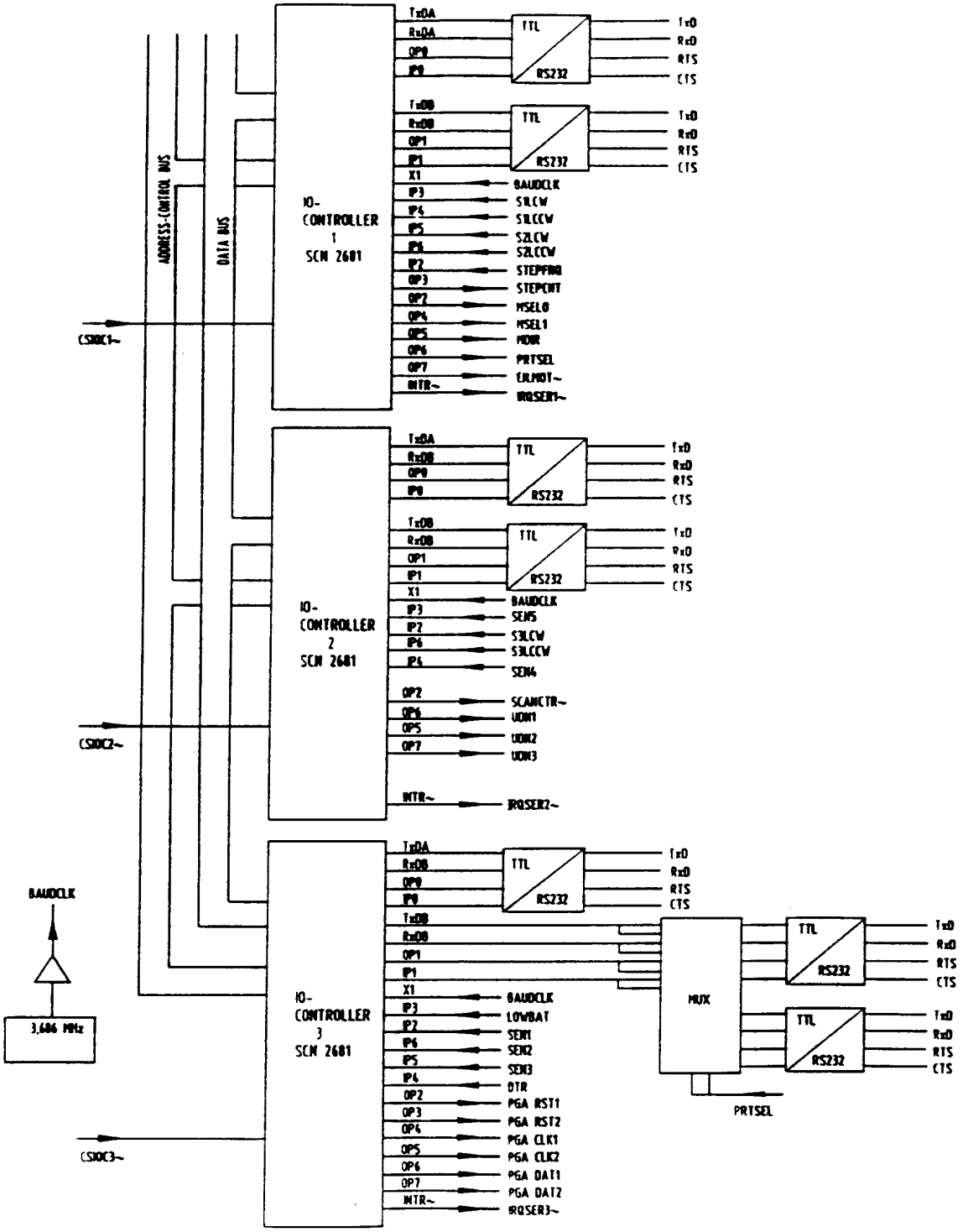
Sediment terminal:

Pin 1 (+5V) : F3 (250 mA fast-blowing)
Pin 4 (+12V) : F1 (250 mA fast-blowing)
Pin 6 (-12V): F2 (250 mA fast-blowing)

Barcode:

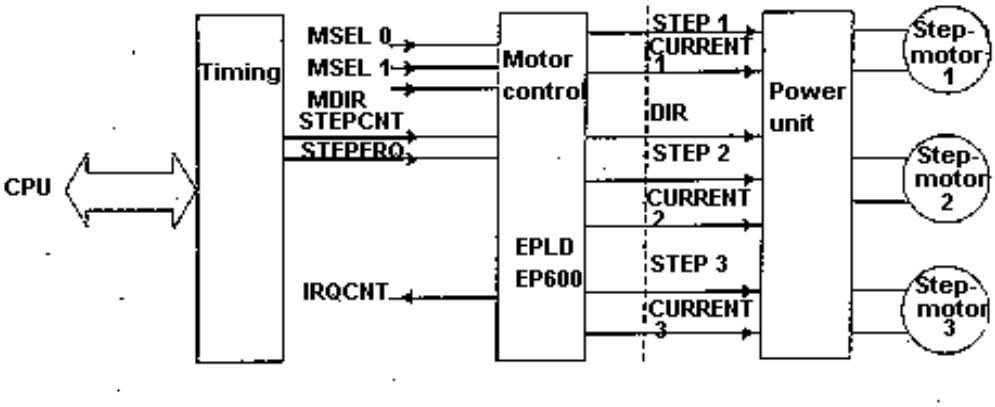
Pin 1 (+5V): F3 (250 mA fast-blowing)
For the pin assignments of the interfaces see chapter 3.7 Input/Output Unit.

The Interfaces - Chart

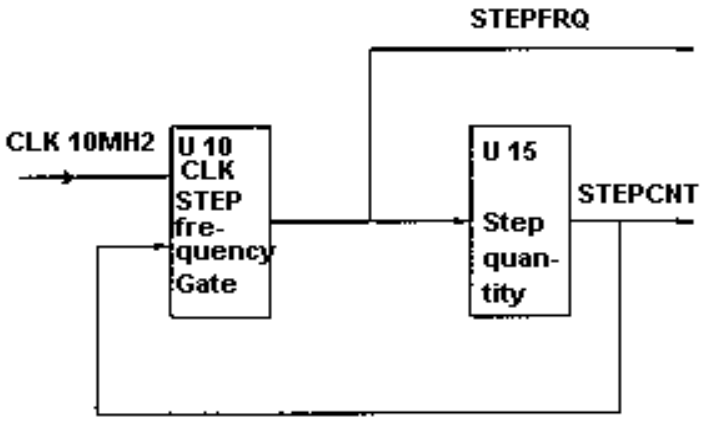


Motor Control

The motor control supports the three step motors and comprises in the following functional blocks. Timing, control and power unit. The power unit is located on the step motor board.

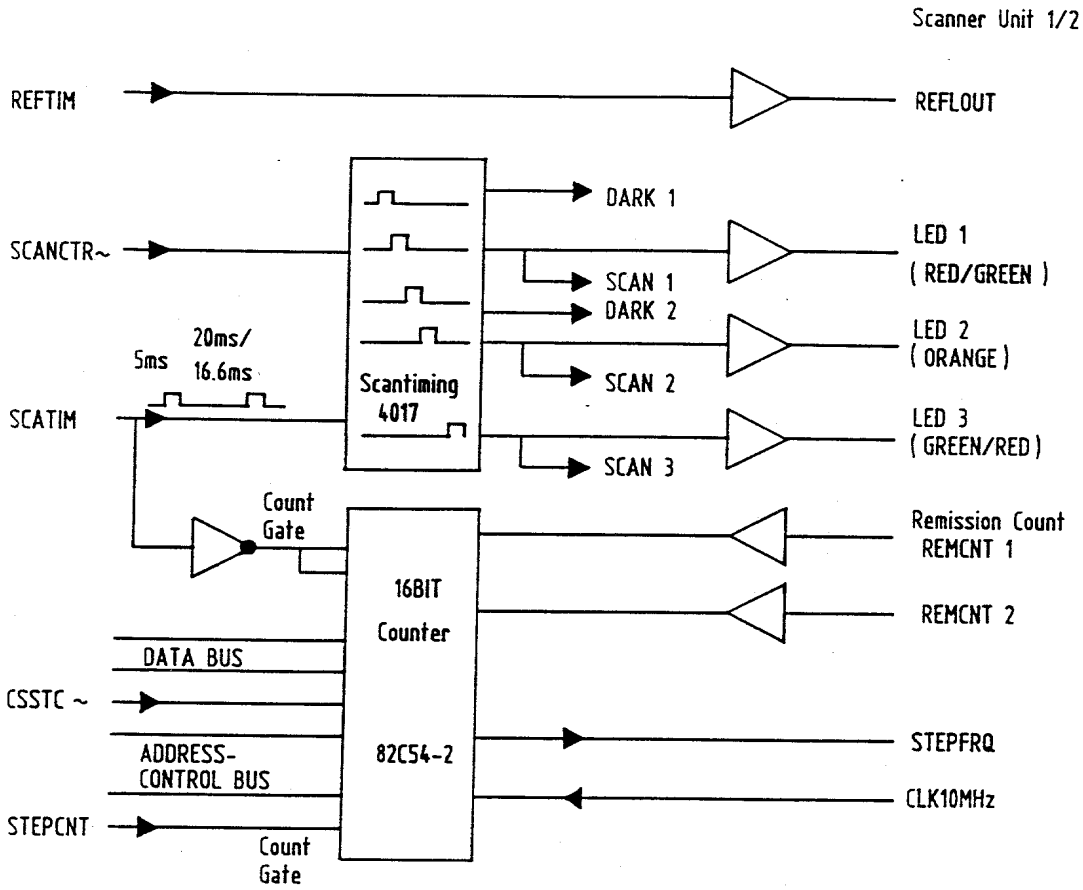


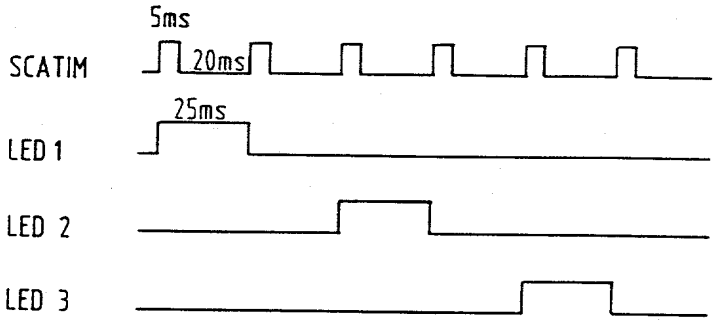
The stepping frequency is generated by Timer U 10 with Timer U 15 serving as a step counter.



Control of the measuring heads

The LEDs of the measuring heads operate in pulse mode. They are activated via counter chip U 33. Time control is provided by the internal timer of the 80C188. U10 releases the remission counts during each break of the SCATIM signal.





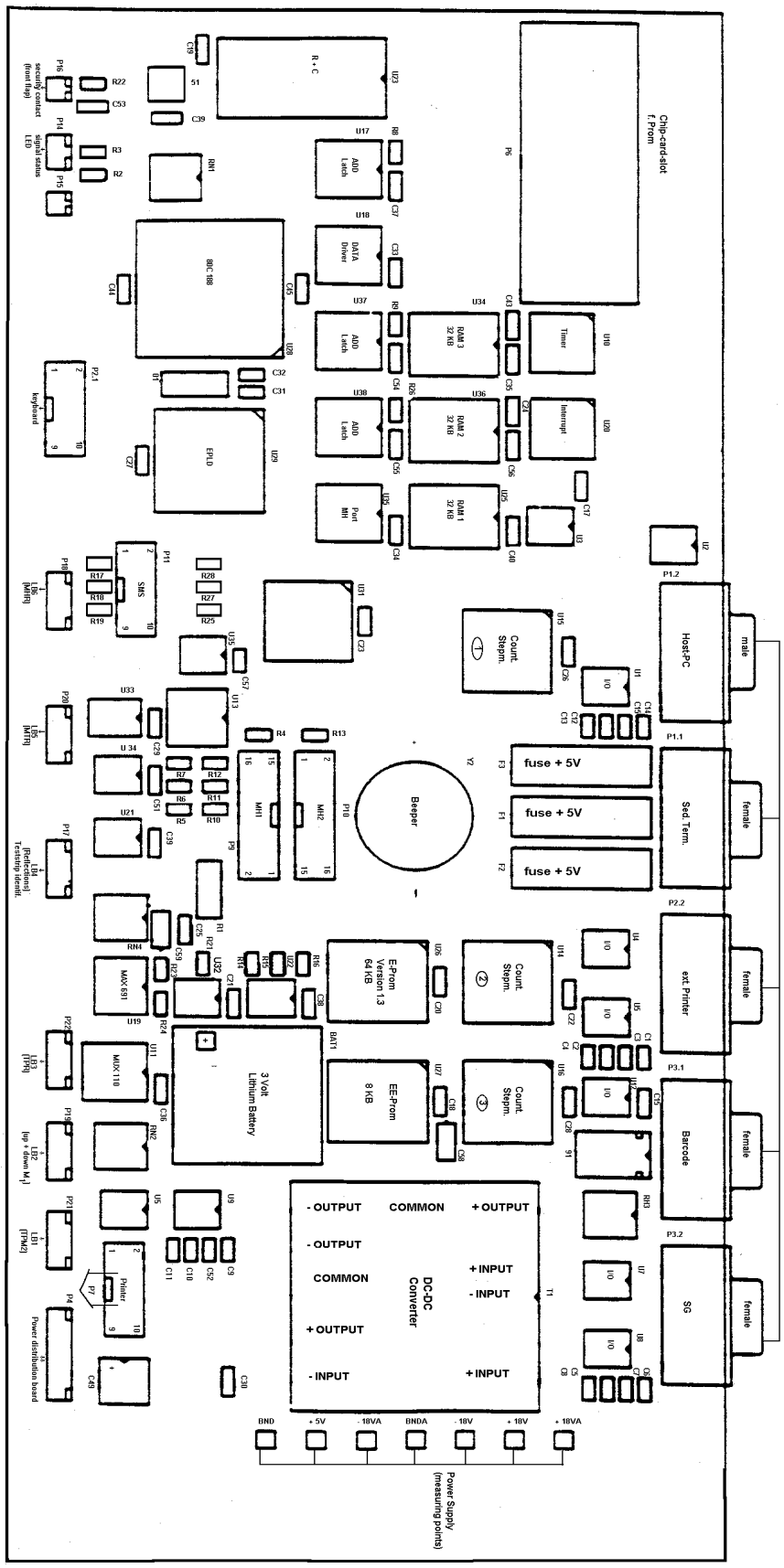
Power Supply Voltage

An 8-pole plug (P4) serves to supply the voltage for the logic circuit (+5 V), the voltage for the supply power feeding the interface chips and to supply the +12 V-12 V voltages to the DC/DC converter.

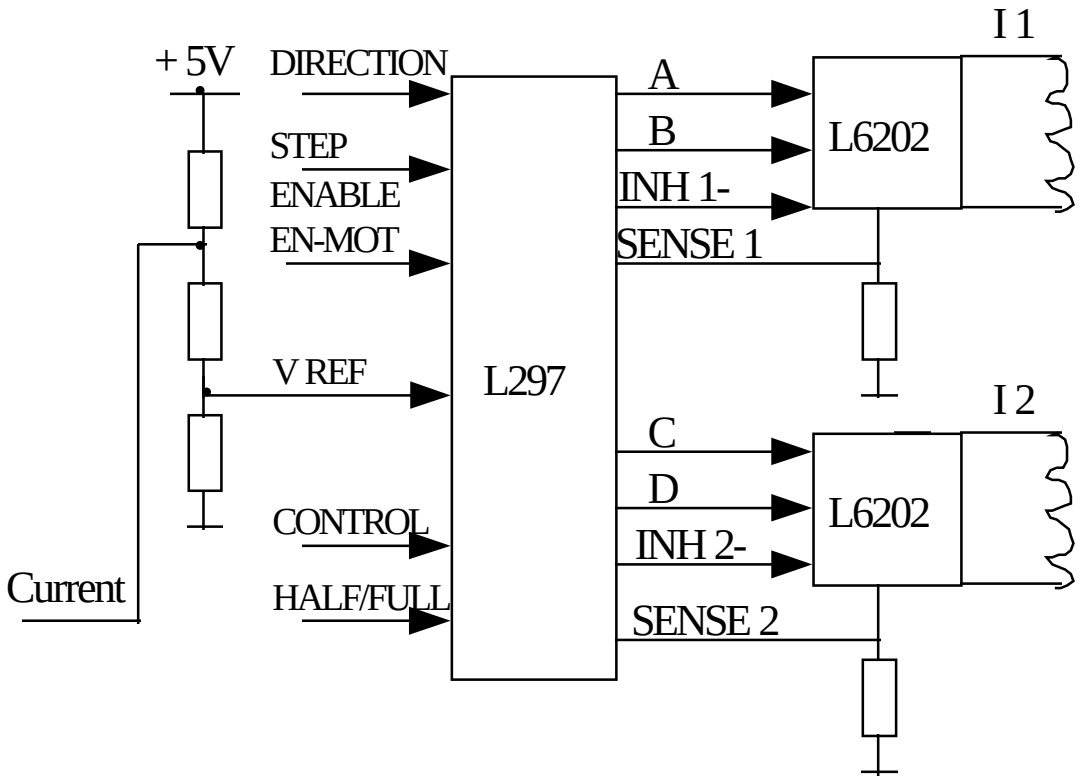
Pin Assignments:

P4	
Pin 1	+5 V
Pin 2	+12 V
Pin 3	-12 V
Pin 4	GND
Pin 5	GND
Pin 6	GND
Pin 7	GND
Pin 8	+12 V

Insertion Plan



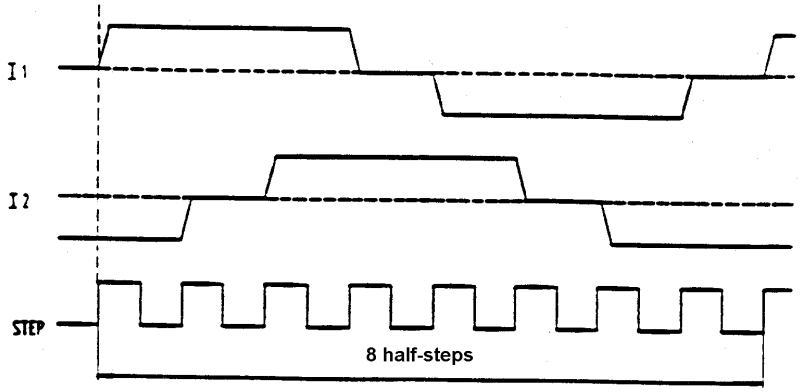
The step motor is designed as a bipolar chopper driver for three step motors and located on the SMS board (back side partition wall). Each step motor is actuated by an L297 actuator chip (U7, U8, U9). Bridge circuits are disposed downstreams of this chip in groups of two.



The power control signal of the motor windings is fed back to the actuator chip via line SENSE 1/2. Power supply is reduced to shut down the motor. To do this, the reference voltage is controlled via the current line. The value of the reference voltage V-Ref and the resulting currents that flow through the motorwindings can be understood from the following table.

Motor		Vref	Imax
Measuring head (M3)	standstill	72 mV	220 mA
	operation	170 mV	520 mA
Board (M2)	standstill	50 mV	150 mA
	operation	120 mV	360 mA
Measuring table (M1)	standstill	72 mV	220 mA
	operation	170 mV	520 mA

The inputs of the Half/Full actuator chip are connected such that the motors operate in half-step mode.



Two voltages are supplied to the step motor control:

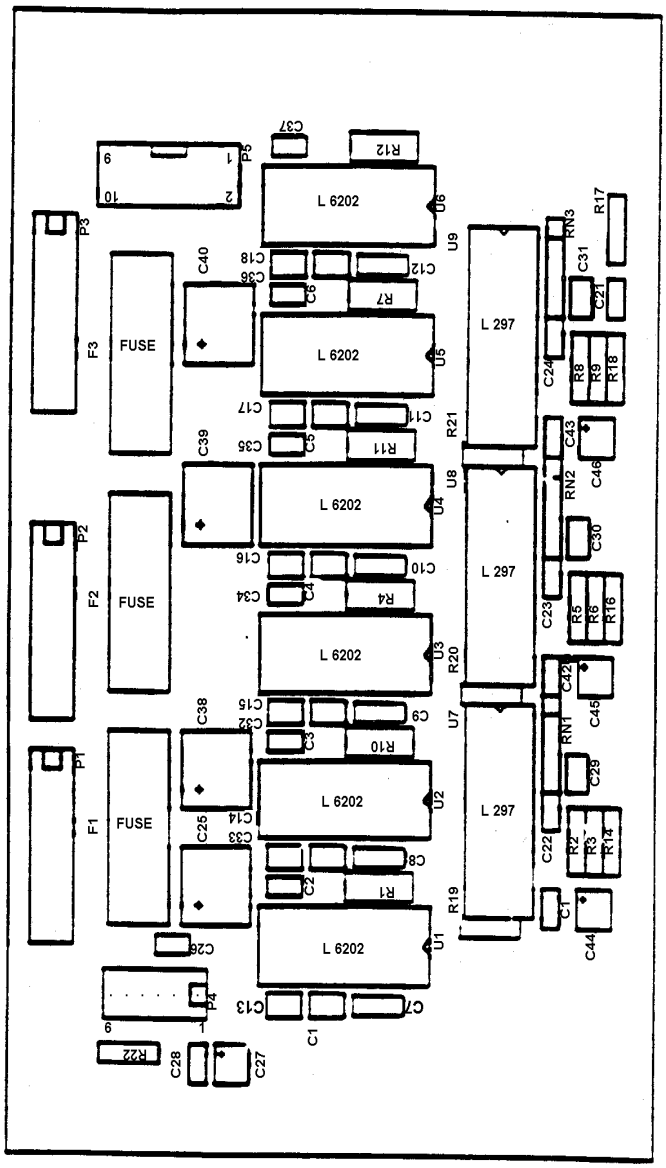
Chip	Voltage	Stand by	Operation
Actuator chip	+ 5V	180 mA	180 mA
Bridge circuit	+24V	365 mA	420 mA

To protect the power supply unit, the three motor control units are separately protected by fast-blowing fuses (+1.25A) in the +24V supply line.

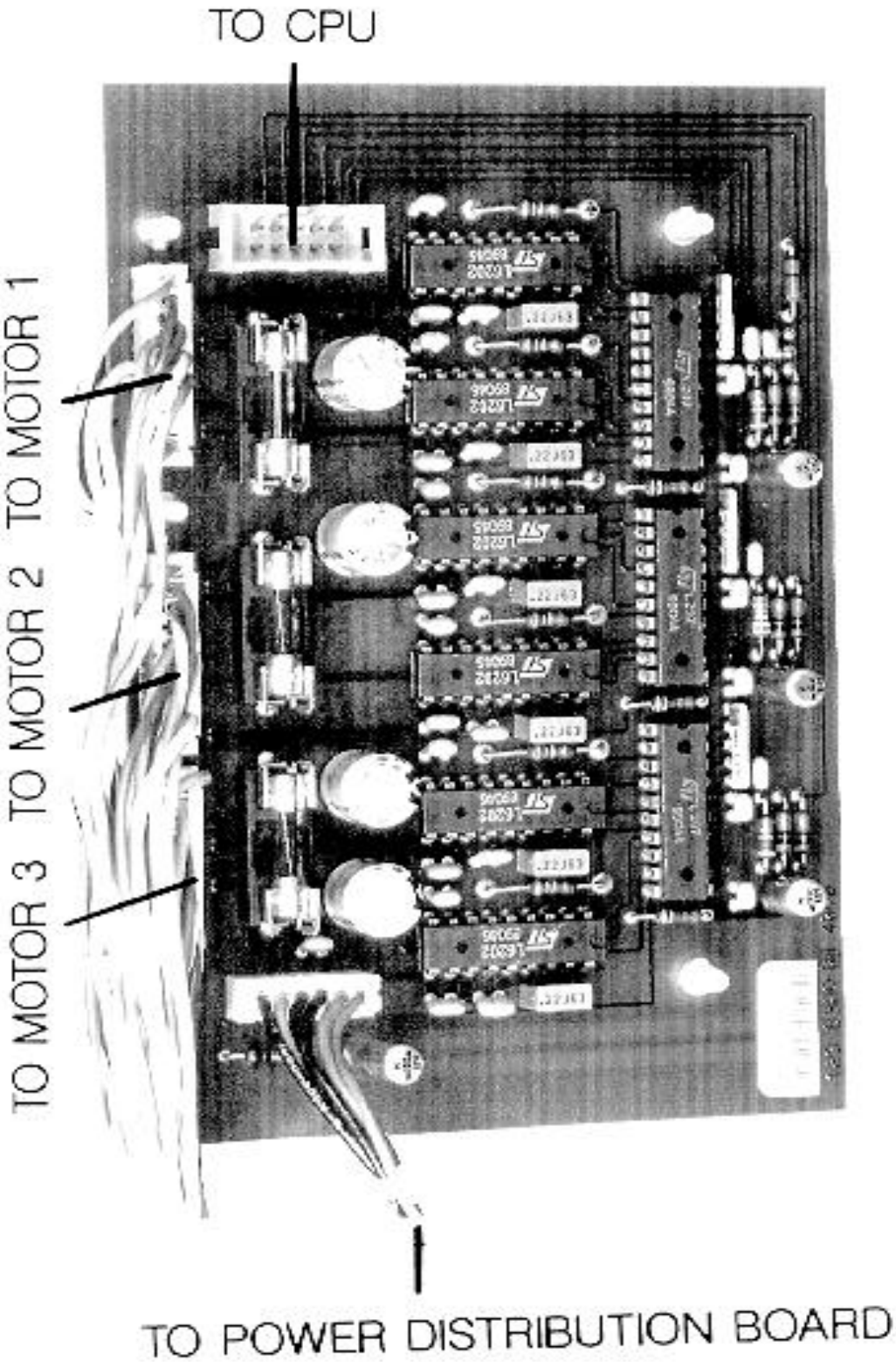
Pin assignment of the voltage supply:

P4	Pin Assignment
PIN 1	+ 24V
PIN 2	+ 24V
PIN 3	GND
PIN 4	GND
PIN 5	+ 5V
PIN 6	GND

Insertion Plan



SMS-Board


TO CPU
TO MOTOR 1
TO MOTOR 2
TO MOTOR 3
TO POWER DISTRIBUTION BOARD

The Miditron uses two identical measuring heads. One measuring unit comprises one analog board and one optoflex board. The optoflex board has three LEDs of the wavelengths 550 nm, 620 nm and 660 nm, respectively, als well as an optohybrid.

The measuring heads are galvanically separated from the upstream electronics unit by means of optocouplers. One bright value and one dark value are determined at each measuring position. A programable amplifier (PGA) serves to set one amplification per wavelength for each bright/dark combination.

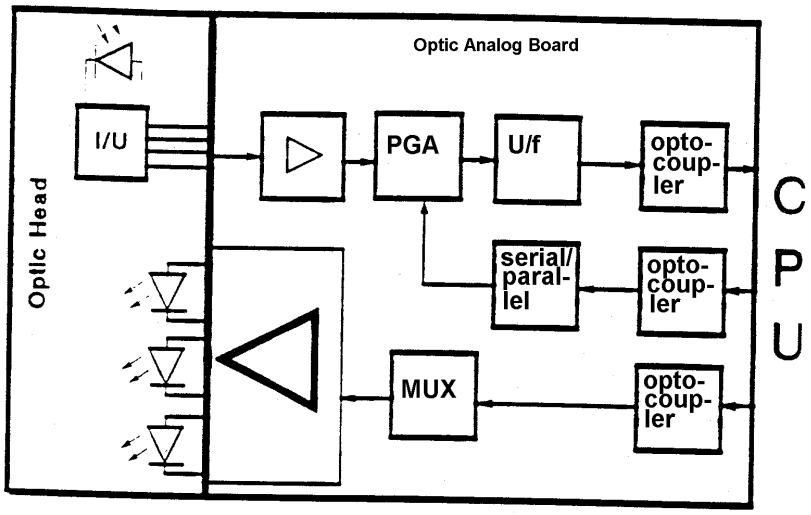
The measured value is calculated as follows:
measuring value=bright value-dark value

The result of this equation is used to calculate the remission values with the measuring values of the internal reference areas being included.

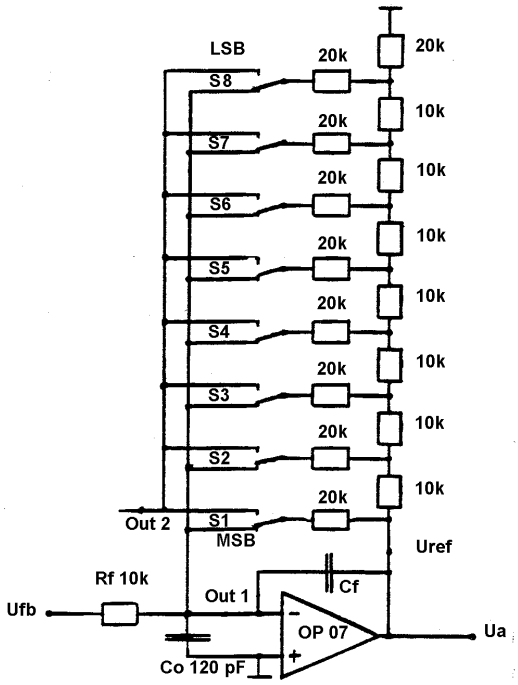
Since both measuring heads measure simultaneously, the LED sequence was set as follows to optimize power consumption.

Measuring head 1	Measuring head 2
dark	dark
green	red
dark	dark
orange	orange
dark	dark
red	green

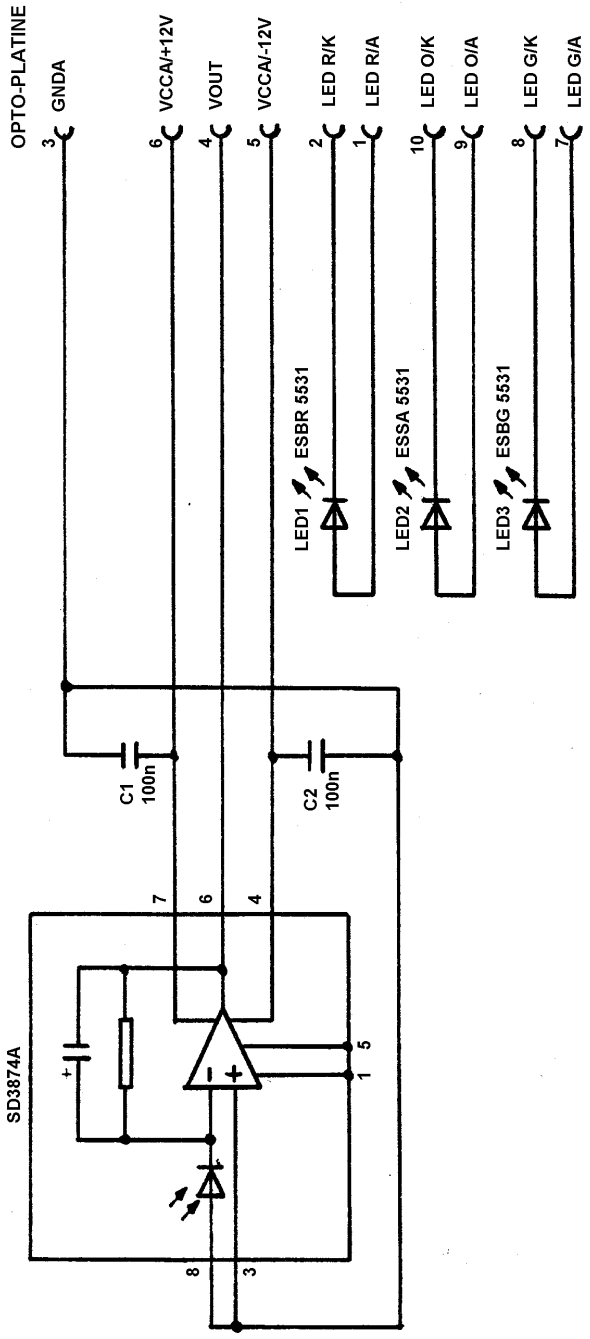
Symbolic circuit



PGA equivalent circuit



Optic - Board


OPTO-PLATINE
3 GNDA
6 VCCA/+12V
4 VOUT
5 VCCA/-12V
2 LED R/K
1 LED R/A
10 LED O/K
9 LED O/A
8 LED G/K
7 LED G/A
LED1 ESBR 5531
LED2 ESSA 5531
LED3 ESBG 5531
C1 100n
C2 100n
7
6
4
SD3874A
1
5
8
3

The Keyboard

All hardware components except the display are accomodated on a mother board. The operator unit communicates with the CPU via an RS 232 interface without hardware handshake (RTS/CTS). The baud rate is determined by the software of the microcontroller.

The keys used are short-stroke keys. The voltage used for the operator unit is +-12 V and supplied via plug connector P2 (Pin 1/10).

The +-5 Vs on the board are generated by controller U6 itself. The board has a total of three plug connectors.

P1: LCD display
P2: CPU
P3: ---
P4: Printer

The Display

The LCD used is a display of 2 lines and 40 characters. Plug connector P1 connects the display to the keyboard.

The Printer

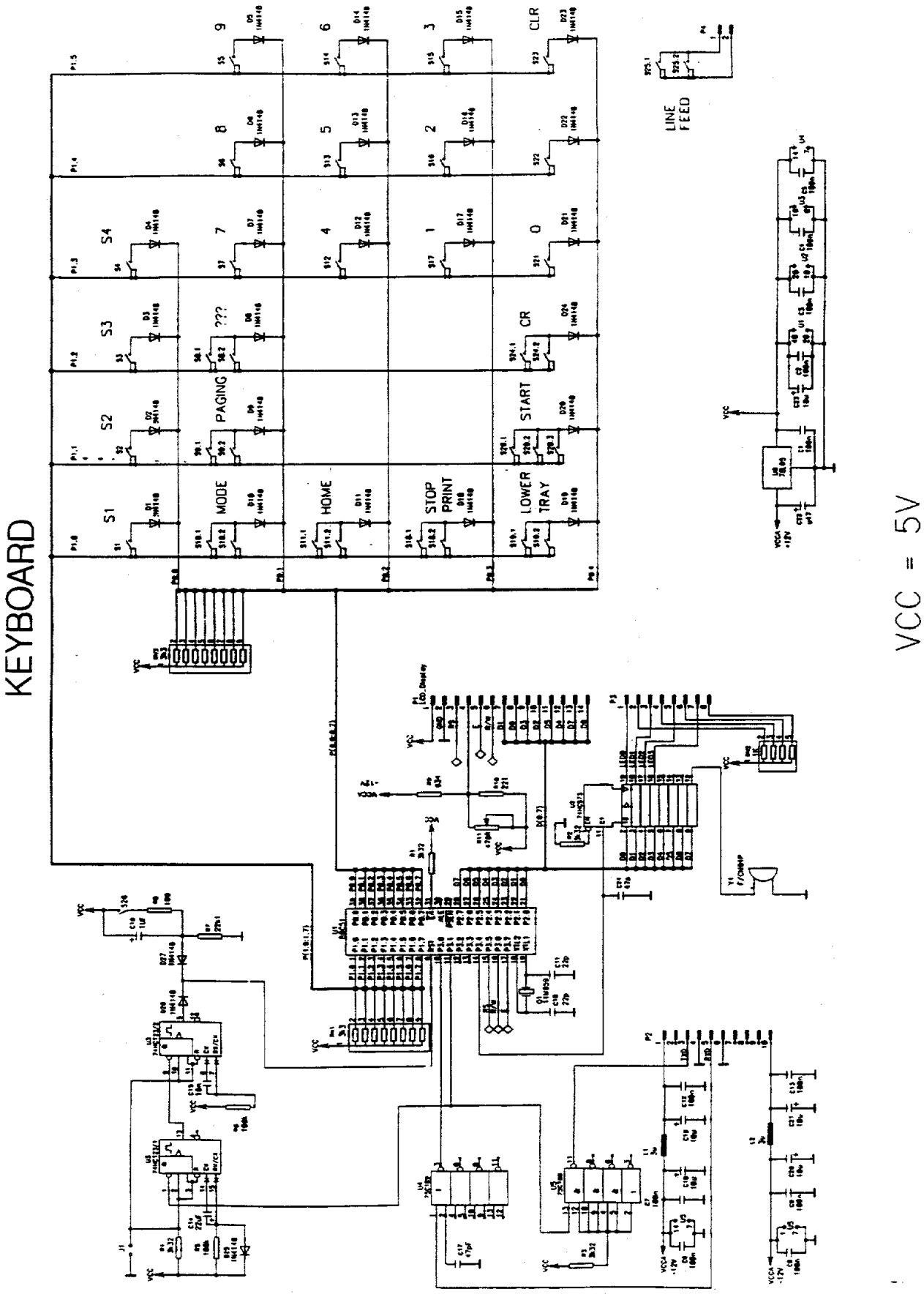
The printer is a High Speed 2-Inch Type Terminal Printer. The printer has three plug connectors.

J1: Power distribution board (P1)
J2: Keyboard (P4)
J3: CPU (P7)

The printer housing also accomodates a fan to ensure that no excessive heat is generated during printing. The printer is connected to the power distribution board via plug P2.

The Interfaces

The assignments of the interfaces used are given in the overview on page 4.


KEYBOARD
VCC = 5V
LINE FEED
MODE
HOME
STOP PRINT
LOWER TRAY
PAGING
START
CR
CLR
S1
S2
S3
S4

Interfaces Miditron

Instrument	Layout lable	Internal term (software)	Type
Host	P 1.2	Interface 1	male
Sediment Terminal	P 1.1	Interface 2	female
Bar-Code	P 3.1	Interface 3	female
S G	P 3.2	Interface 4	female
Keyboard M	P 2.1	Interface 5	pin base
Printer Int.	P 7	Interface 6.2	pin base
Printer Ext.	P 2.2	Interface 6.1	female

Pin-connection

P 1.1	
No	term
1	+5 V
2	RXD\
3	TXD\
4	12 V
5	GND
6	-12 V
7	RTS
8	CTS
9	

P 1.2	
No	term
1	
2	RXD\
3	TXD\
4	
5	GND
6	
7	RTS
8	CTS
9	

P 2.1	
No	term
1	+12 V
2	
3	RXD\
4	GND
5	TXD\
6	GND
7	CTS
8	
9	RTS
10	-12 V

P 2.2	
No	term
1	
2	RXD\
3	TXD\
4	
5	GND
6	DTR
7	RTS
8	CTS
9	

P 3.1	
No	term
1	+5 V
2	RXD\
3	TXD\
4	
5	GND
6	
7	RTS
8	CTS
9	

P 3.2	
No	term
1	
2	RXD\
3	TXD\
4	
5	GND
6	
7	RTS
8	CTS
9	

P 7	
No	term
1	
2	
3	RXD\
4	GND
5	TXD\
6	DTR
7	CTS
8	
9	RTS
10	

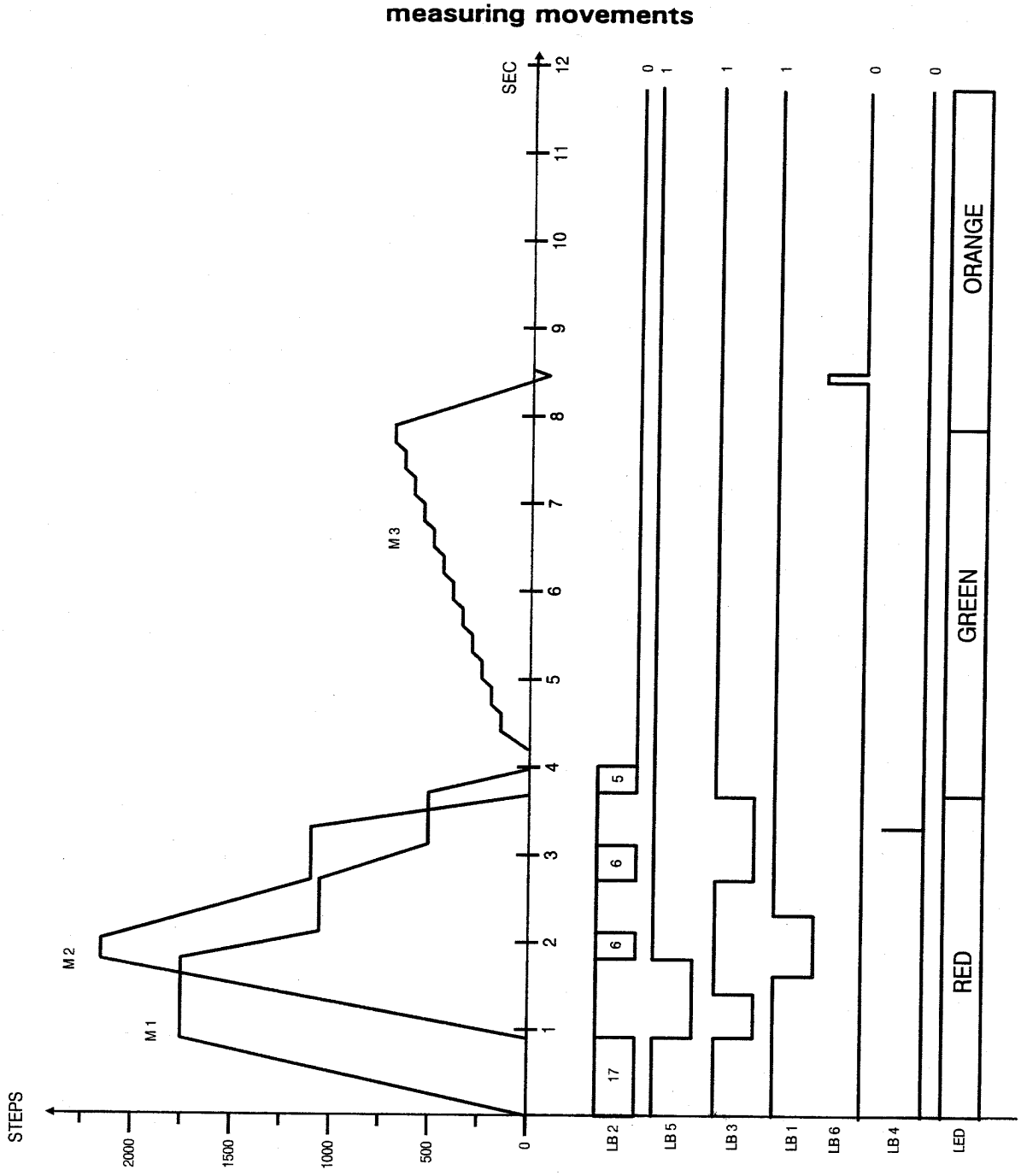
There are altogether 8 sensors built in the Miditron

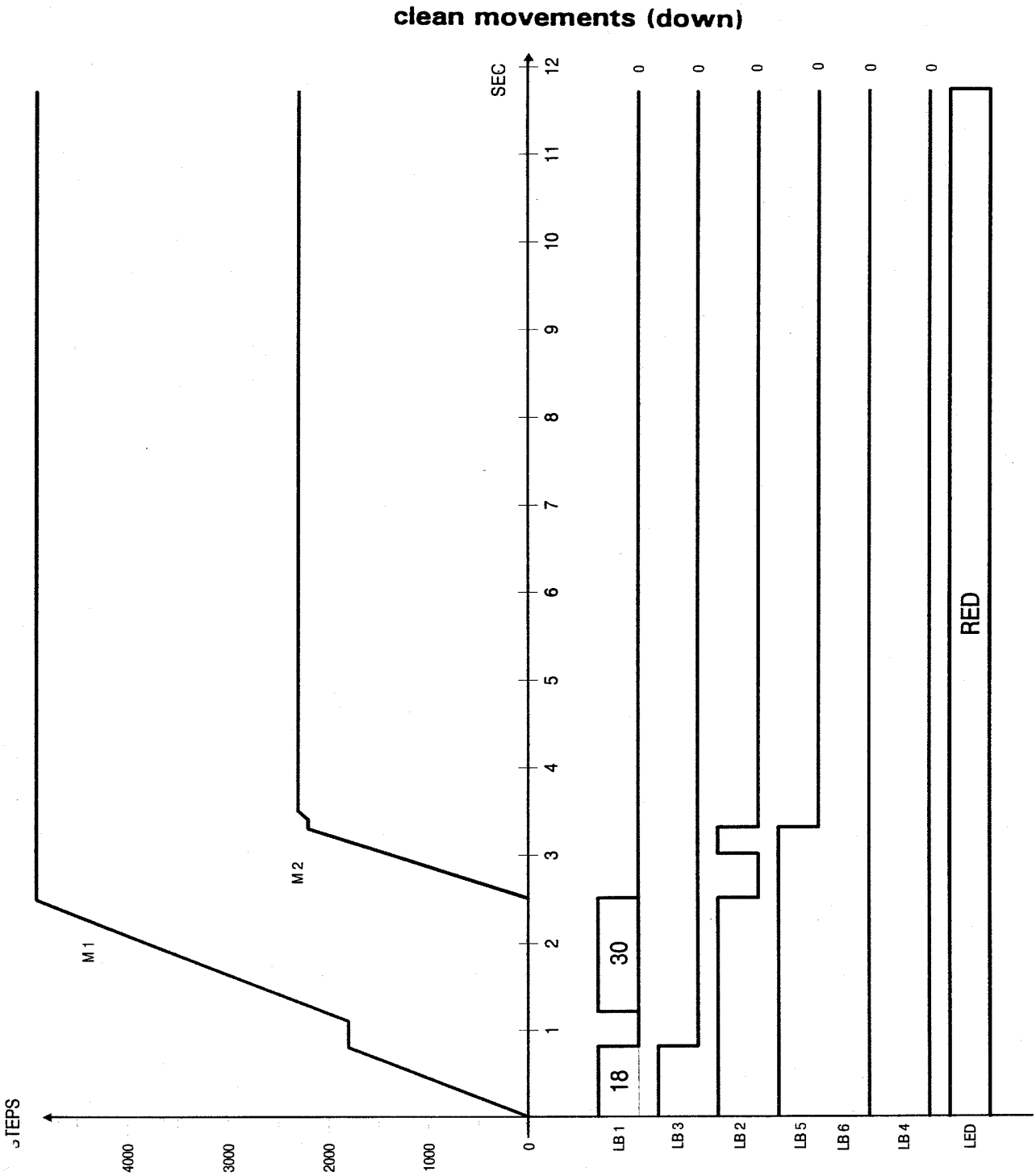
- Finger sensor (P 16)
- Signal LED (P 14)
- Fork light barrier for transport plate reference position (P 21)-(1)
- Fork light barrier for measuring table motor (P19)-(2)
- Fork light barrier for transport motor (P22)-(3)
- Reflection light barrier for test strip identification (P 17)-(4)
- Fork light barrier for measuring table reference position (P 20)-(5)
- Fork light barrier for measuring head reference position (P 18)-(6)

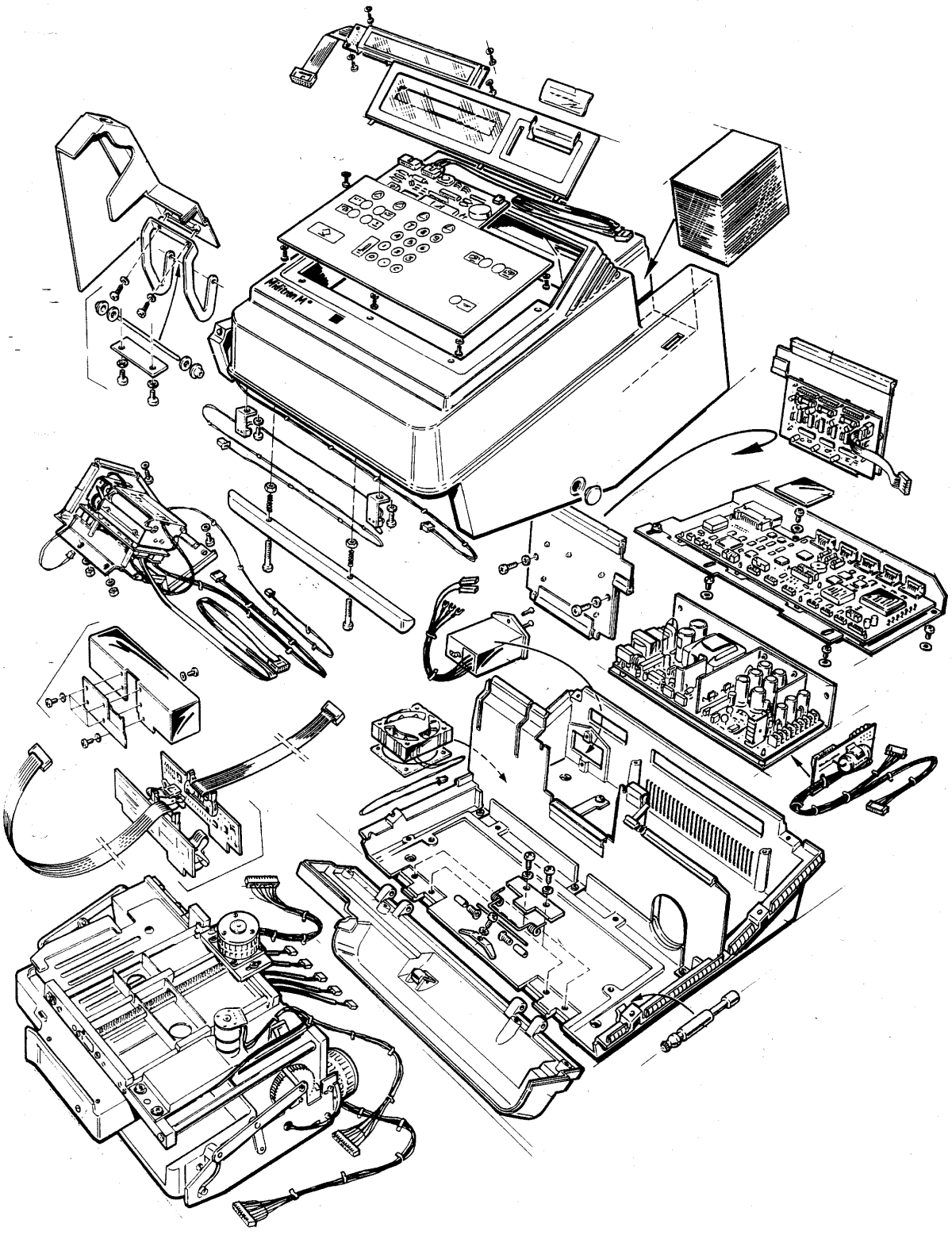
The fork light barrier leads a (+4 V) high signal if they are covered and to a low signal (OV), if uncovered.

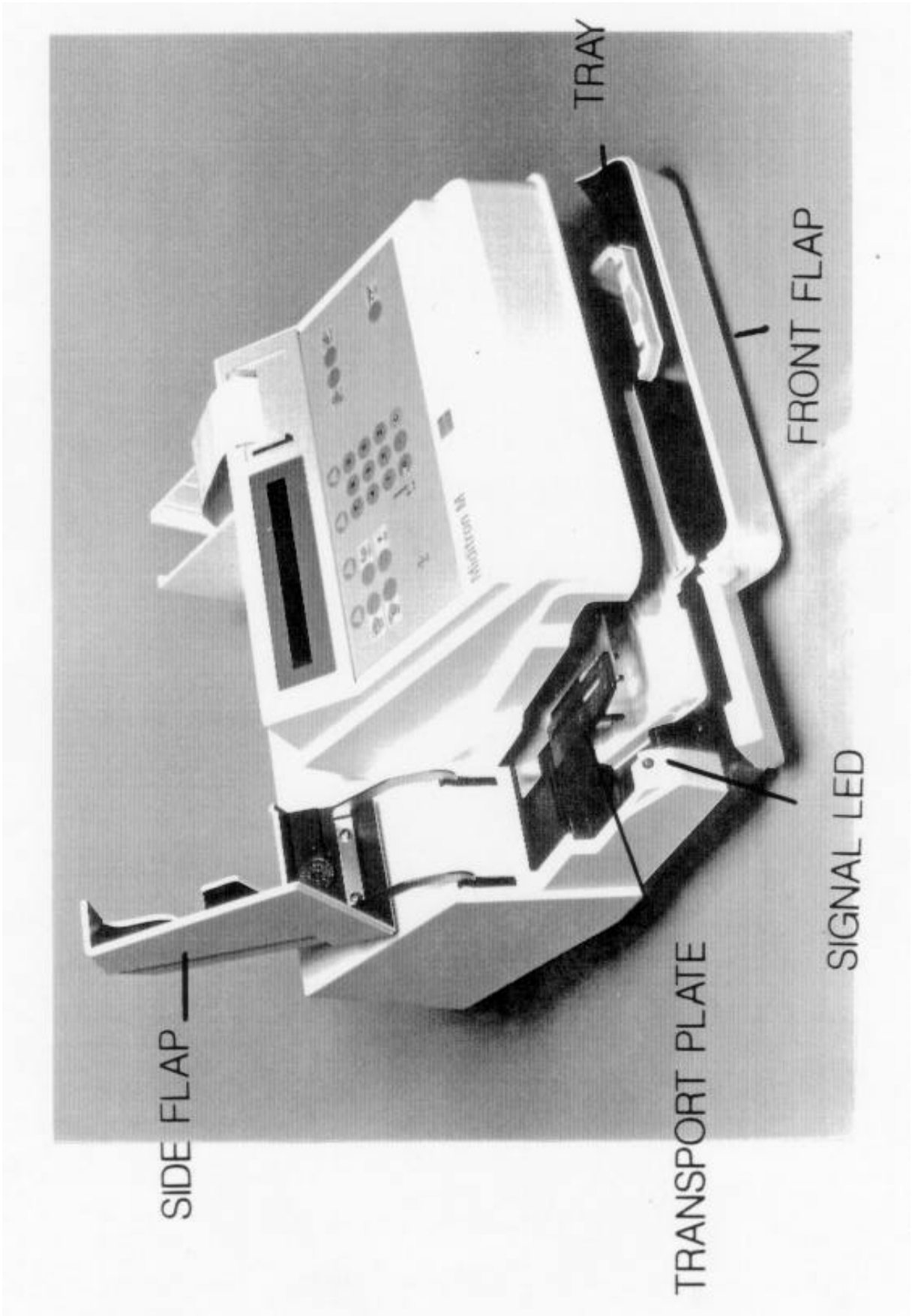
The finger sensor consists of 2 contact switches which can be released by means of a contact ledge to the front part of the top housing through AND/OR to a connection to P 16 CPU.

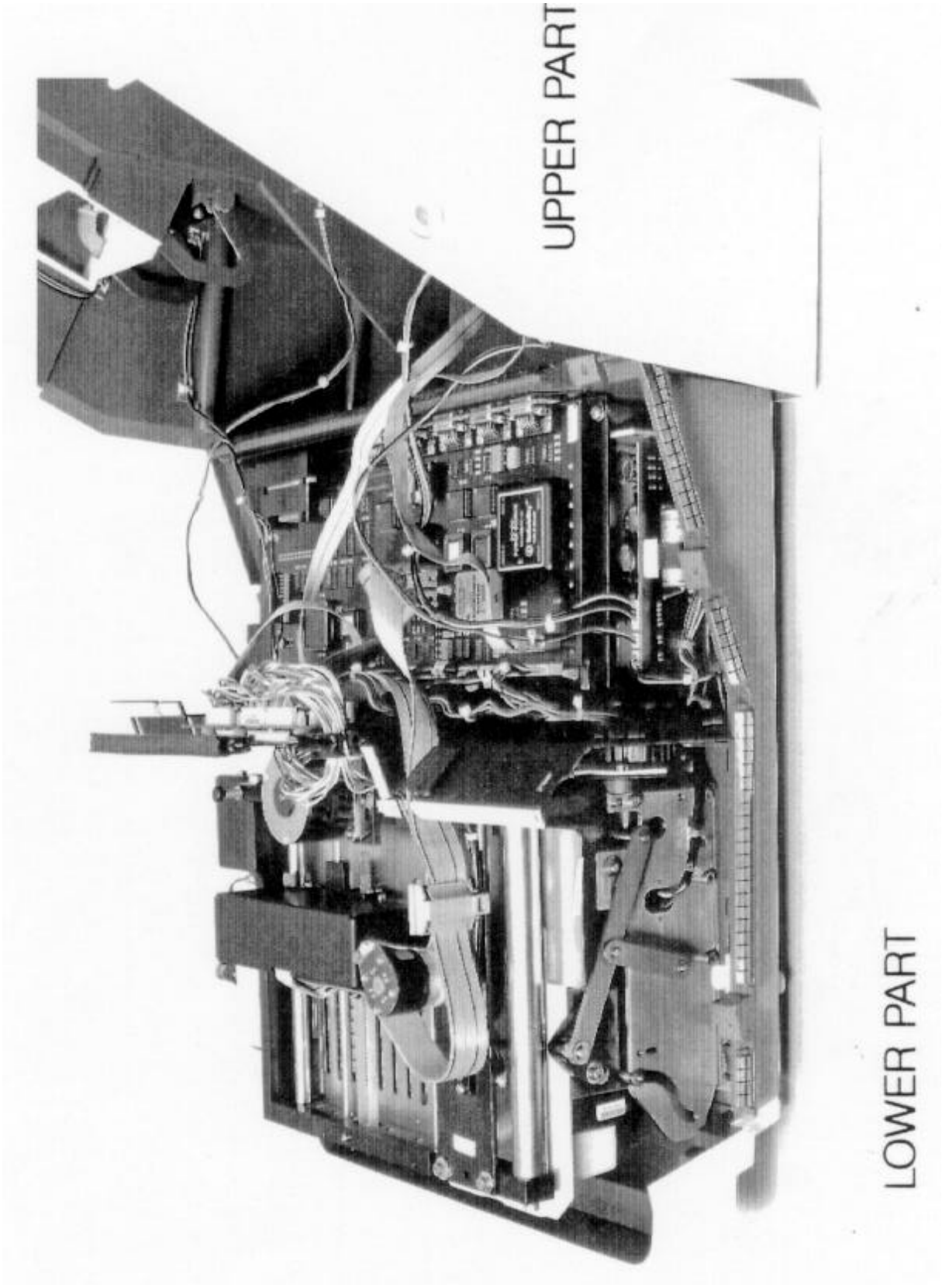
On releasing the sensors the mechanic immediately stops and the measuring table eventually moves to the clean position.


measuring movements
SEC
STEPS
M1
M2
M3
LB2
LB5
LB3
LB1
LB6
LB4
LED
RED
GREEN
ORANGE


clean movements (down)
SEC
0
1
2
3
4
5
6
7
8
9
10
11
12
M 1
M 2
4000
3000
2000
1000
0
18
30
LB 1
LB 3
LB 2
LB 5
LB 6
LB 4
LED
RED




SIDE FLAP
TRAY
FRONT FLAP
TRANSPORT PLATE
SIGNAL LED


UPPER PART
LOWER PART

The measuring module is a compact mechanical unit and mounted to the housing bottom by means of 4 screws.

Two of these screws are only visible when the measuring table is lowered down. If you need to reach these when the motor is not functioning, use the hand crank.

The measuring module can be disassembled in the following individual components.

Measuring table
RLB 4
Transport plate
Guide rail rear
reference plate
Guide rail front
toothed belt
toothed disk
Drive unit for transport plate
cam disk complete
LB3
motor 2
Measuring head complete
measuring head cover
measuring head 1
measuring head 2
measuring head carrier
clamping spring for toothed wheel
Set of joints left, right
Drive unit for measuring table
motor 1
LB 1,2,3,4,5,6
Guide bar for measuring heads 1,2
Motor 3

A more detailed disassembly is not recommended with this knowledge of the matter and should therefore not be attempted.

In case defects are more complicated, send the entire measuring module for repair to Mannheim (RA procedure).

The following software is available for the Miditron system:

- User software (Program card 1)
- Service software (Program card 1)
- Service software II (Program card 2)
- Data connect program (PC Program UDC)

User software

The entire user software is installed on an external program card (I) which is found on the back of the instrument. The program card cannot be overwritten (one touch Eprom).

The user software is devided in 3 functional parts, each part is secured by a code No. to prevent unauthorized access. The first software-part regards instrument settings and test parameters and is secured by code No. 1991. These parameters are permanently stored in the EEprom. The third software-part contains the service software I and is designed for telephone trouble shooting.

Service Software I

Service software I is the third part of the user software and is secured by code No. 0621. The software is structured in such a way that telephone services are extensively possible.

Service software II

This software is installed on the external program card II. This card is provided for BM service technicians only and contains extensive service routines in checking errors (see chapter 5.3).

Data connect program

This software is designed for RD field reps. and serves to change the instrument settings as required, by programming the Miditron via PC. A possibility of a customer-data-bank containing customers' data and instrument data should be made available. This is particularly helpful when servicing the instrument in case of a breakdown.

Service Software Program card 1:

To access this software part press:

Paging-1991-Paging-F4-0621

After input of the second code number the system prints out the amount of mechanic cycles and the last 17 error messages.

Service

Date:		01.01.92
Time:		13:24
Cycles:		0000001738
	104	22.07.92
	125	24.07.92
	105	24.07.92
	125	24.07.92
	133	24.07.92
	133	24.07.92
	105	01.08.92
	133	05.08.92
	133	05.08.92
	133	05.08.92
	133	05.08.92
	104	05.08.92
	104	05.08.92
	104	05.08.92
	200	21.08.92
	125	23.08.92
	200	28.08.92

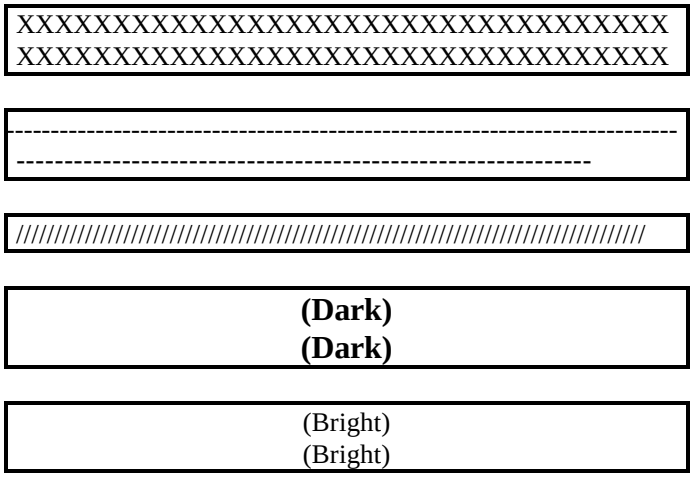
The following menu is displayed at the same time:

Service program >
Display/Keyboard/Printer/Selftest

Service Menu 1:

F1 F2 F3 F4

F1: Display test



The main menu is displayed again automatically upon completion of these tests.

F2: Keyboard test

Any key pressed will be displayed.
This routine function can be interrupted by pressing BACK.

F3: Printer test

This test initiates an automatic printout of the printer to check for possible printer malfunctions.

F4: Internal Self Test

This test runs on the major chips on the CPU board as well as on the program card. During this test (appr. 1.5 minutes) only the upper display line will indicate that the test is running. The result will then be printout.

Date:	**10.02.92**	
	Selftest	
Eprom	**Test**	**pass**
Chipcard	**Test**	**pass**
EEprom	**Test**	**pass**
Battery	**Test**	**pass**
RTC	**Test**	**pass**

Paging: Service Menu 2

Service progam: >
Interface / M-Cycle / Cal.Data / Transport

F1 F2 F3 F4

F1: Interface Test

Interface test: >
Host / Sedi / Printer / Barcode

Paging

Interface test: >
SG /

The activation of one of these interfaces will generate a test with a subsequent print-out of the result.

To run this test it is necessary to bridge the two lines RXD (Pin2) and TXD (Pin3).

F2: Measuring Sequence Check

When the F2 function key is pressed, the complete measuring cycle will be executed followed by a print-out of the measuring values of the internal reference field (dark counts of the LEDs, bright counts of the LEDs at the reference field and the resulting remission values, step loss occurring at all three motors).
A list of the last 17 error messages will also be printed out again to give an update on the errors that occurred earlier.

Date: 25.11.94
M-Cycle

	Measuring Head 1			Measuring Head 2		
mm:	555	620	660	555	620	660
CD:	889	890	887	922	923	926
CL:	3108	3103	3082	3130	3138	3180
R:	63.90	63.00	62.80	63.90	63.00	62.80

M1:	+	0
M2:	-	2
M3:	+	2

Normal value range for the counts:

Dark counts:	500 to 2000
Bright counts:	< 6000
Difference in dark/bright counts:	- 40 to < 3700

Remission values for the internal reference field:

G: 63,9% O: 63,0% R: 62,8%

Normal range for step loss:

M1:	+/- 5 steps
M2:	+/- 10 steps
M3:	+/- 5 steps

F 3 : Calibration Data

Erase all calibration data ?
YES | | | NO

This test automatically produces a 24 page print-out of the last 10 calibration values with one print-out for one measuring head and one measuring area. Any drift can thus be immediately detected (one possible reason being a slowly progressing deterioration of the LEDs)

The Erase Yes/No prompt allows the operator to delete all calibration data including the factory-set calibration data !

Date: 25.12.94
CALIBRATION VALUES (REM%)

Measuring Head 1 Measuring field 0

	555	620	660nm
09/20/93	63.90	63.00	62.80
11/04/93	63.90	63.00	62.80
12/10/93	63.90	63.00	62.80
03/29/94	63.90	63.00	62.80
10/17/94	63.90	63.00	62.80
11/07/94	63.90	63.00	62.80
07/11/94	63.90	63.00	62.80
07/26/94	63.90	63.00	62.80
07/26/94	63.90	63.00	62.80
07/26/94	63.90	63.00	62.80

Date: 25.11.94
CALIBRATION VALUES (REM%)

Measuring Head 2 Measuring field 11

	555	620	660 mn
09/20/93	62.89	62.94	62.00
11/04/93	62.89	62.94	62.00
12/10/93	62.89	62.94	62.00
03/29/94	62.89	62.94	62.00
10/17/94	62.89	62.94	62.00
10/07/94	62.89	62.94	62.00
07/11/94	62.89	62.94	62.00
07/26/94	62.89	62.94	62.00
07/26/94	62.89	62.94	62.00
07/26/94	62.89	62.94	62.00

F 4: Secure for Transport

Replace transport plate please Press CLEAN to close the system

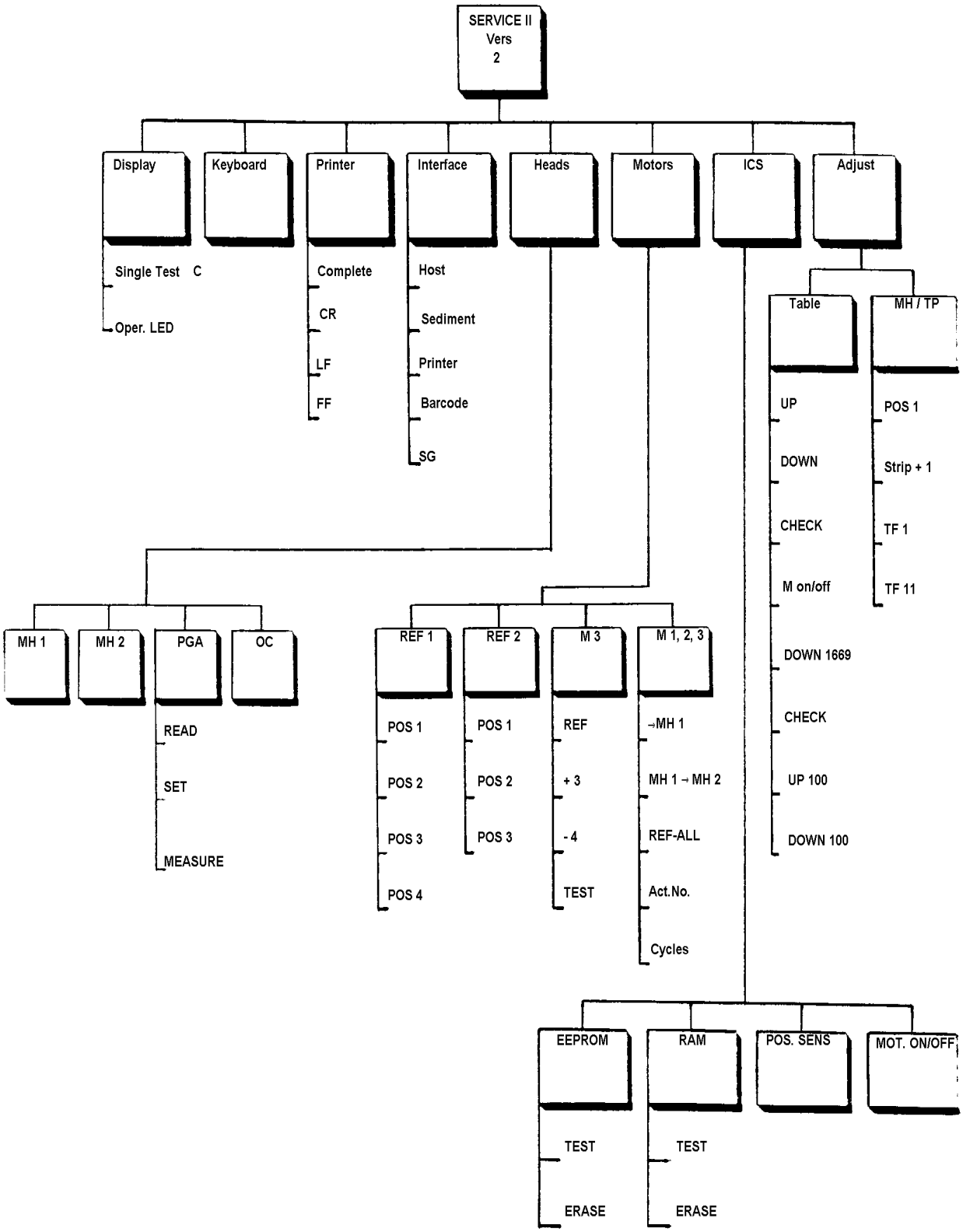
The instrument will open automatically and the transport plate can be removed. Then place the white styrofoam piece on the transport plate to prevent damages which may occur during shipping or transport.

Instrument is locked for transport. Please switch off the instrument

Turn off the instrument once it is closed. The above message will then be displayed.

Replace transport plate please Press CLEAN to close the system

Softwarestructure



The service software II is located on a separate program card. After inserting this program card, switch on the instrument and on the display the following messages appear:

```
**********MIDITRON**********

waiting for POWER Up-message
```

```
Chipcard II V2.1
```

```
                Service 1      >

Display  /  Keyboard  /  Printer  /  Interface
```

Function keys: (F1) (F2) (F3) (F4)

To activate one of the menus, you have to press one of the four function keys (F1..F4) which are located under the display.

To reach the service menu 2 you have to press PAGING.

```
                Service 2      >

            Heads  /  Motors  /  ICs  /  Adjust
```

Explanations:

F1:	press function key 1
F1.1:	press function key 1 then function key 2
P, F2:	press PAGING then function key 2

Service main menu 1

Keys to press:

F1 (Display)

```
Service :          Display test
 Single test   |   Oper. LED  |
```

F1.1 (Single test) Every 5 sec. the Display will change as follows:

```
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXX
```

```
------------------------------------------------------------------
--------------------------------------------------
```

```
||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
```

```
          (Dark)
          (Dark)
```

```
          (Bright)
          (Bright)
```

F1.2 (Oper.LED) The operator LED will change the colour from green to red to orange continually until you press F2 again.

```
                Service 1                >
Display  |  Keyboard  |  Printer  |  Interfaces
```

F2 (Keyboard) Every button you press will now be shown on the display. To abort this test press BACK.

```
Service:          Keyboard test
Key pressed: ----->
```

Keys to press:

F 3 (Printer)

```
Service :          Printer test
 Complete  |    CR     |    LF     |    FF
```

F3.1 (Complete) you get a printout of the software transmitting test
(you have to insert paper before you switch on the instrument)

F3.2 (CR) The software sends a carriage return to the printer

F3.3 (LF) The software sends a line feed to the printer

F3.4 (FF) The software sends a form feed to the printer

F4 (Interface)

```
Service :       Interface test 1              >
  Host     | Sediment |   Printer   |   Barcode
```

F4,P

```
Service :       Interface test 2              >
        SG  |
```

F4.1;F4.2;F4.3;
F4.4;F4,P,F1 :

If you activate one of these interface tests please make a short cut between the pin 2 and 3 of this interface socket !

Keys to press:

Paging

Service 2 >			
Heads	Motors	ICs	Adjust

P.F1 (Heads)

Service : Heads			
MH1	MH2	PGA	QC

P.F1.1 (MH1)
P.F1.2 (MH2)

The measuring-head measures the bright and dark counts of the actual measuring head-position by using the PGA counts you set or measure before.

Bright	2182	2024	1627
Dark	923	923	827

P.F1.3 (PGA)

PGA-BYTE Range 0..255		
SET	READ	MEASURE

P.F1.3.1 (SET)

For all heads and LEDs you can set the same individual byte (don´t set ´0´ because the amplifier needs a feedback.)

Enter PGA-BYTE = _

P.F1.3.2 (READ)

The actual PGA-Bytes (you have set or measured before) are displayed. (The default setting is 128)

PGA-MK1 GOR	71	75	97
PGA-MK2 GOR	89	69	89

P.F1.3.4 (Measure)

The PGA bytes are calculated by using the internal reference pat.

Keys to press:

P,F1.1 (Heads)

```
Service : Heads
     MH1    |    MH2    |    PGA    |    QC.
```

P,F1.1.4 (QC) The instrument measures one teststrip and initiates a printout of the results.

```
Insert strip please
Press Start to continue
```

Attention:
Only the results which are printed in both types are valid for the check strip.

P,F2 (Motors)

```
Service : Motors
   REF 1   |   REF 2   |    M 3    |  M 1,2,3
```

P,F2.1 (REF1) Motor 1 turns to the reference position
P,F2.2 (REF2) Motor 2 turns to the reference position

P,F2.3 (M3)

```
Service :  Motor 3
     REF    |    + 1     |    - 1     |  Test
```

P,F2.3.1 (Ref) Motor 3 turns to the refence position
P,F2.3.2 (+1) Motor 3 turns 1 step forward
P,F2.3.3 (-1) Motor 3 turns 1 step back
P,F2.3.4 (Test) Motor 3 turns from position 0 to 11 and back controlling the motor steps. (Lost steps have to be between +- 5 steps)

P,F2.4 (M1,2,3)

```
Service : Motor 1,2,3                          >
  ->MH1  |  MH1->MH2  |  Ref-ALL  |  Act.No
```

P,F2.4.1 (->MH1) Strip is transported to measuring head 1
P,F2.4.2 (MH1->MH2) Strip is transported from measuring head 1 to 2
P,F2.4.3 (Ref-ALL) All motors turn to the reference positions

Keys to press:

P,F2.4.4 (Act.No) now you can run special movings with motor 1,2,3

```
Enter Action-No :
```

Every motor has several action numbers to turn.
You find the action no. list on page 5.3-11.0-01.92
(Att.: you can´t leave without an action no.)

P,F2,P

```
Service : Motors 1,2,3                    >
      Cycles
```

P,F2,P,F1 (Cycles)

```
Service : Motors 1,2,3
No of cycles: _
```

The number of cycles you key in is the number of cycles the mechanic will run. (Stop with back)

P,F3 (ICs)

```
Service : ICs
  EEProm   |   RAM    |  POS Sens.  |  Motor ON
```

P,F3.1 (EEPROM)

```
                    EEPROM
   TEST    |   ERASE  |
```

P,F3.1.1 (TEST) Check of the EEprom function

P,F3.1.2 (ERASE) Erase all Data which are stored in the EEPROM

P,F3.2 (RAM)

```
                      RAM
   TEST    |   ERASE  |
```

P,F3.2.1 (TEST) Check of the RAM function

P,F3.2.2 (ERASE) Erase all Data which are stored in the RAM
(after erasing data you have to start the instrument again)

Keys to press:

P,F3.3 (Sensors)

```
 0   I  0   | 1  |  1  |  1  |  0  |  1  |  1  | 1
MHR | MTM | MTR | TPM | TPR | RFL | SAV | BAT|SMB
```

You can see now the current signals of all sensors :

MHR	: measure head reference
MTM	: measure table motor
MTR	: measure table reference
TPM	: transport plate motor
TPR	: transport plate reference
RFL	: reflection light barrier
SAV	: Finger sensor signal
BAT	: battery power control (> 2.4 V =1)
SMB	: step motor board connect signal

P,F3.4 (Motor on) You can switch off /on the power of the motors

P,F4 (Adjust)

```
Service :  Adjust
   TABLE   |   MH / TP |
```

P,F4.1 (TABLE)

```
Status:   LB-2 = 0                          >
   UP      |  DOWN  |    Check    |  M  ON
```

P,F4.1.1 (UP) Motor 1 turns 1 step upwards, the new signal status is displayed

P,F4.1.2 (DOWN) Motor 1 turns 1 step downwards, the new signal status is displayed

P,F4.1.3 (Check) The software checks the status of the LB-2 signal continually

P,F4.1.3.4.3 The software checks the status of the LB-2 signal continually

```
LB-2 Signal = 0
              |             |             |       OK
```

Keys to press:

P,F4.1.3.4 (OK) Motor 1 turns to the reference position
P,F4.1.3.4.3.4 Motor 1 turns to the reference position

```
Control ----> 16,4 mm
              |          |  Check  |  OK
```

P,F4.1.3.4.4 (OK) Motor 1 turns 1669 steps downwards
P,F4.1.3.4.4.3 (Check) Motor 1 turns to reference position and then 1669 steps downwards

```
LB-5 Signal =  1
              |          |          |  OK
```

P,F4.1.3.4.4.4 (OK) The pos. and neg. signal positions from LB-5 are measured. (If the difference between pos. and neg. signal is more than 10 steps, the routine will stop and show the measured step positions)

```
Pos: + 1678 NEG: + 1670
              |          |  Check  |  OK
```

P,F4.1.3.4.4.4 (OK) Motor 1 turns back to reference position

```
Service :  Adjust
   TABLE  |  MH / TP  |
```

Keys to press:

P,F4.1,P

Status: LB-5 = 1			>
Down 1669	Check	UP 100	Down 100

P,F4.1;P,F1 (Down) Motor 1 turns 1669 steps downwards (see P,F4.1.3.4.4.3)

P,F4.1,P;F2 (Check) (see P,F4.1.3.4.4.4)

P,F4.1,P,F3 (UP 100) Motor 1 turns 100 steps upwards

P,F4.1,P,F4 (DOWN 100) Motor 1 turns 100 steps downwards

P,F4.2 (MH/TP)

Service : MH/TP			
Pos 1	Strip +1	TF 1	TF 11

P,F4.2.1 (Pos 1) Transporting of a strip to measuring head 1

P,F4.2.2 (Strip +1) Transporting of a strip to the next position

P,F4.2.3 (TF 1) Moving of measure head to test field 1

P,F4.2.4 (TF 11) Moving of measure head to test field 11

Table of action numbers

Motor	Act. No.	Direc	Steps	Remarks
1	17	+	200	1 motor turns upwards
1	6	+	485	from 1. down pos. to top-pos.
1	4	+	579	from 2. down-pos. to 1 down-pos.
1	2	+	674	from 3. down-pos. to 2. down-pos.
1	16	+	6000	don't use
1	0	-	1738	from top-pos. to 3. down-pos.
1	10	-	3000	from 3. down-pos. to clean-pos.
2	22	-	80	
2	15	-	1500	TP from In-pos. to Ref.pos.
2	1	-	2147	TP from 2. In-pos. to Catch-pos.
2	13	-	3000	TP from 2. In-pos. to Out-pos.
2	12	+	1031	TP from Catch-pos. to 1. In-pos.
2	3	+	1116	TP from 1. In-pos. to 2. In-pos.
2	14	+	1500	
2	5	+	2290	
2	11	+	4000	don't use
3	21	+	40	
3	8	+	44	MH from TF n to TF (n+1)
3	18	+	100	
3	7	+	148	MH from TF 0 to TF 1
3	20	-	3	
3	9	-	632	MH from TF 12 to TF 0
3	19	-	800	don't use
3	23	-	4000	don't use
3	24	-	4000	don't use

Hardware requirements for UDC program

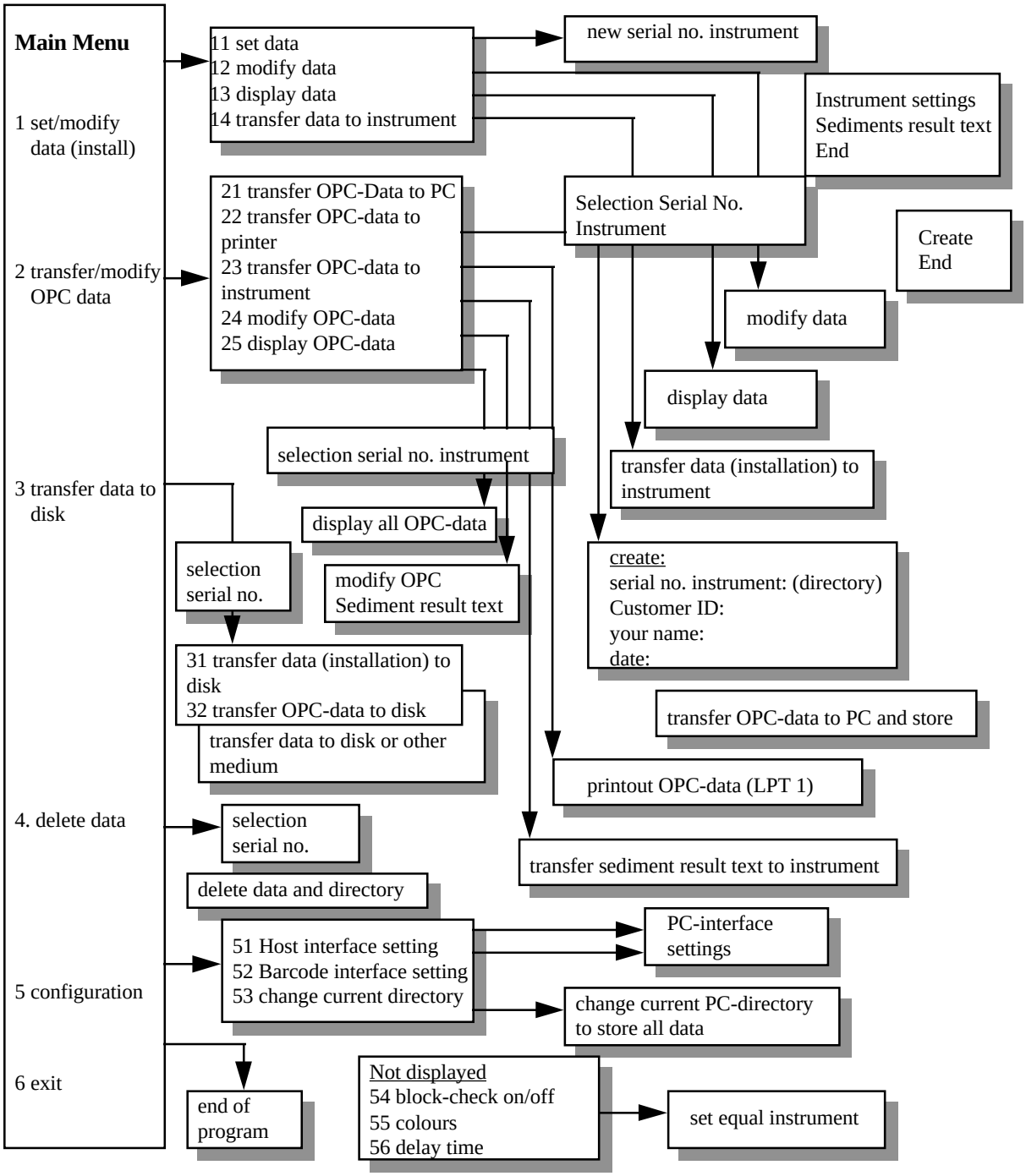
1. IBM compatible PC (XT/AT) with hard disc
2. operating system: DOS 3.3 and higher
3. minimum of free memory space:
   1,5 MB for program and 10 KB for each instrument data set
4. serial interface port (COM 1/2)
5. transmitter cable (9 pin, female/male)
6. mini size gender changer (9 pin, female)

plug: 9 pin, female	plug: 9 pin, male
1: NC	1: NC
2: TXD	2: RXD
3: RXD	3: TXD
4: don't care	4: don't care
5: GND	5: GND
6: don't care	6: don't care
7: don't care	7: don't care
8: don't care	8: don't care
9: don't care	9: don't care

Installation of UDC-program on hard disc

1. insert the floppy disc in the PC floppy drive
2. activate the floppy drive (v.e. a:\)
3. type in „install" and follow the orders on the screen
4. remove the floppy disc and press ENTER (the program starts automatically)
5. confirm the interfaces under menu 5

Program „UDC“ RD Mannheim GmbH



Please start the program by keying in „UDC“

The main menu screen appears:

>>>Urinalysis Data Communication Program<<<

Main menu

1 Set/Modify Data (Installation)
2 Transfer Data to disc
3 Transfer Data to disc
4 Delete Data
5 Configuration
6 Exit

Interface Host = Com1:9600,N8,1
Interface Barc. = Com1:9600,N,8,1
Block check (LRC) = off

Selection: Directory = C:\UDC\Data

Version 2.0a Boehringer Mannheim GmbH

Select with ↑↓ or input number

After the first call up, please check the following settings:

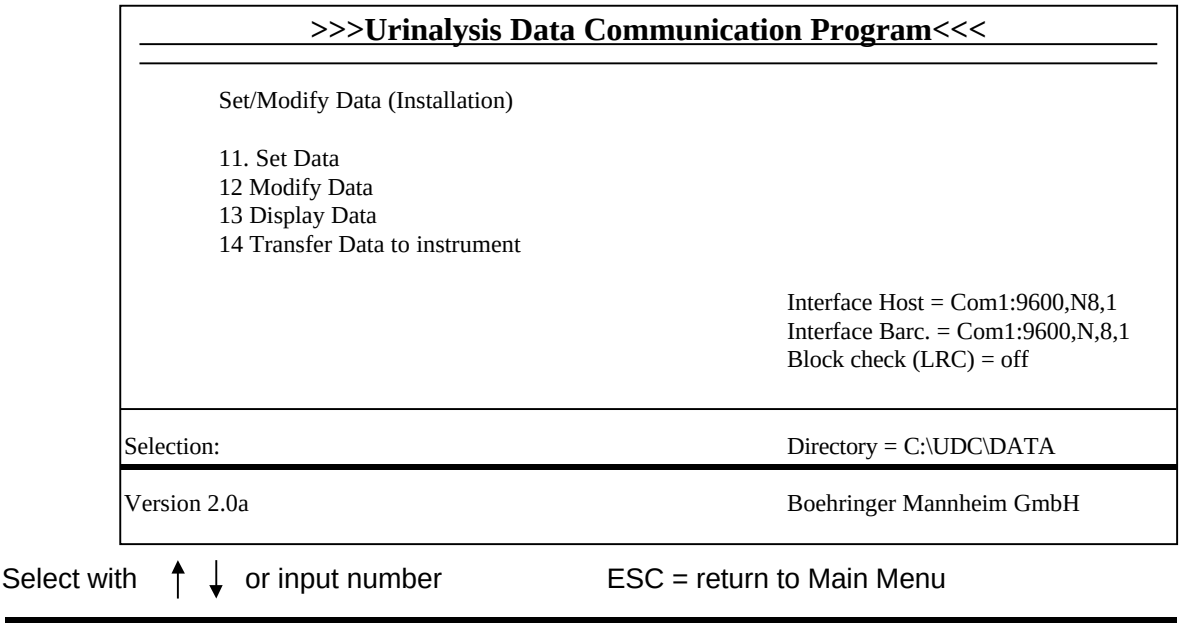
1. Interface Host (menu 5.1 see page 8)
2. Interface Barcode (menue 5.2 see page 8)
3. Directory for storing data (menu 5.3 see page 8)

→ to activate the PC-interfaces please confirm items 1 and 2 first.

→connect the PC to the Miditron Host-interface to receive data

→connect the PC to the Miditron barcode-interface to send data

Menu 1: set or modify installation data



1.1 Create new sediment result texts or/and instrument settings.
These data are stored under a serial number of the instrument (given by the operator) with the extension. NEW in directory DATA.

1.2 Choose a stored instrument number (extension. NEW) to modify the settings.

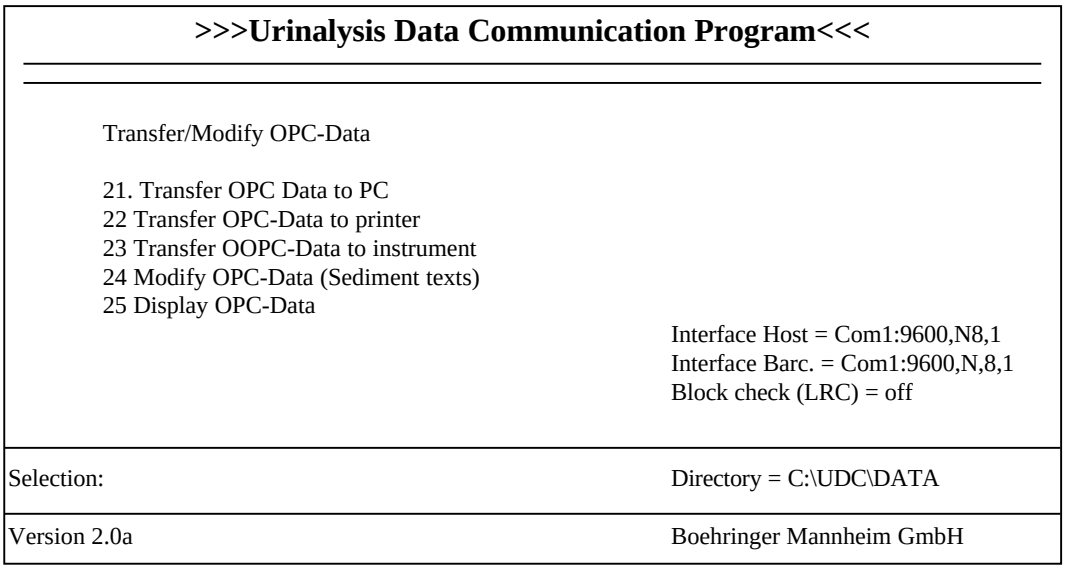
1.3 Choose a stored instrument number (extension.NEW) to display the settings.

1.4 Choose a stored instrument number (extension.NEW) to come to the following sub menu:

1 = Sediment result text
2 = Instrument settings
3 = All data
ESC = Back to main Menu

After the choice the Header of the data appears on the screen (Serial no.; Customer ID.; your name.; Dat of setting).
Before sending data, please make sure that the instrument shows the main menu (M) and that the cable is connected to Barcode interface of the Miditron instrument.
During the transmission both screens (PC/Miditron) show the transmitted data.

Menu 2: Transfer or modify OPC data



Select with ↑ ↓ or input number ESC = return to Main Menu

2.1 Before starting the transmission from the Host-interface of the Miditron to the PC, the UDC-program asks for the Header data (serial no.; customer ID.;name; date). the transmission runs after activating the upload by the Miditron instrument (menu M1.1.2).
These data are stored with the extension. SER in directory DATA.

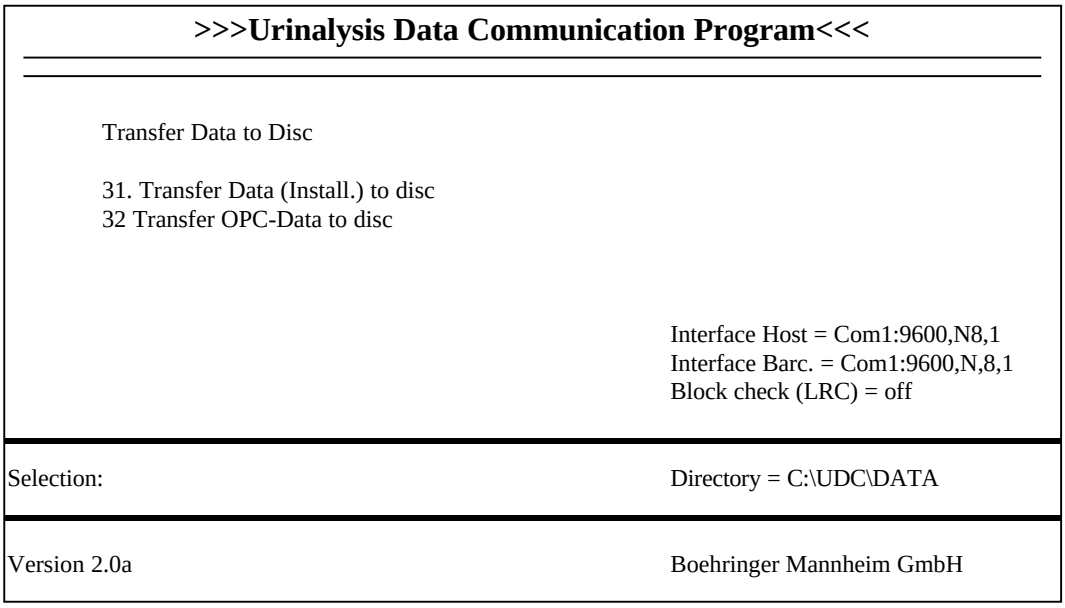
2.2 Choose a stored instrument number (extension.SER) to print out all transmitted data. Please make sure that the printer is ready and connected to the activated PC-interface (you will find the print out form attached).

2.3 Choose a stored instrument number (extension.SER). The header data appears to confirm the choice. Please make sure that the instrument is connected via Barcode interface and the screen shows the main menu (M).

2.4 Choose a stored instrument number (extension.SER) to modify the transmitted sediment texts of the instrument.

2.5 Choose a stored instrument number (extension.SER) to display all transmitted data from the instrument.

Menu 3: Transfer data to floppy disc

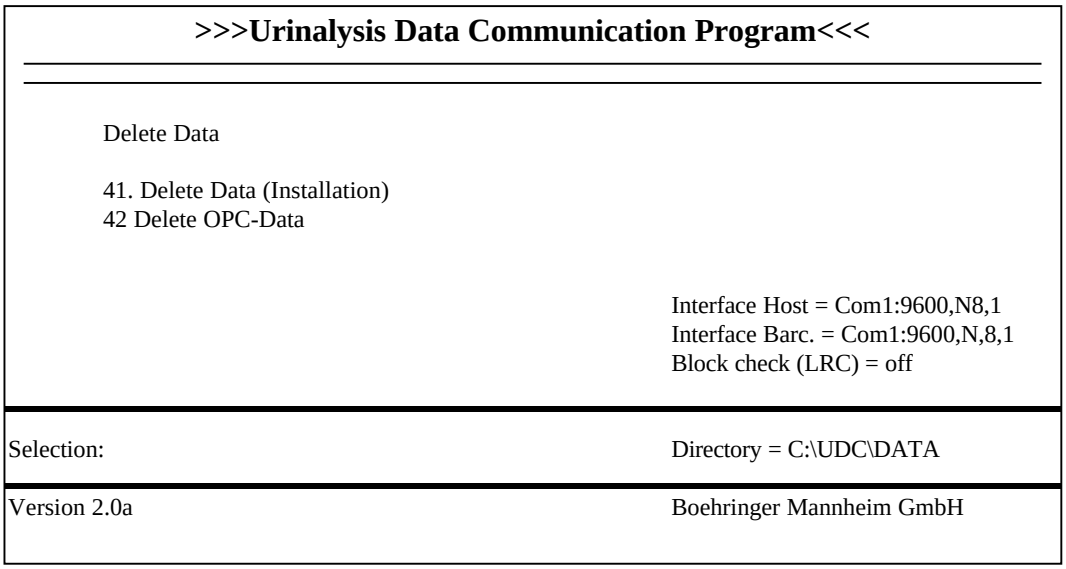


Select with ↑ ↓ or input number ESC = return to Main Menu

3.1 Choose a stored instrument number (extension.NEW) to copy the data on disc. Please make sure that target path is correct and a floppy disc is inserted.

3.2 Choose a stored instrument number (extension.SER) to copy the data on disc. Please make sure that the target path is correct and a floppy disc is inserted.

Menu 4: Delete stored data from hard/floppy disc



Select with ↑ ↓ or input number ESC = return to Main Menu

4.1 Choose a stored instrument number (extension.NEW) to delete the data on hard disc.

4.2 Choose a stored instrument number (extension.SER) to delete the data on hard disc.

Menu 5: Set or modify PC configuration

>>>**Urinalysis Data Communication Program**<<<

Configuration

52. Host Interface setting
53 Barcode Interface setting
54 Change current Directory

Interface Host = Com1:9600,N8,1
Interface Barc. = Com1:9600,N,8,1
Block check (LRC) = off

Selection: Directory = C:\UDC\DATA

Version 2.0a Boehringer Mannheim GmbH

Select with ↑ ↓ or input number ESC = return to Main Menu

5.1 Current HOST Interface settings: „COM1;9699;N;8;1;CS,DS;RS“
5.2 Current HOST Interface settings: „COM1;9699;N;8;1;CS,DS;RS“

Port	Baud-Rate	Barity	Bit/Character	Stop-Bits
COM 1*	1200	none *	7	1 *
COM 2	2400	even	8 *	2
	4800	odd		
	9600 *			

Confirm each section (default =*) and save settings with „Y“, ENTER, ESC.

5.3 If you want to change the current directory to save data please set a new (existing !) directory and confirm with ENTER:
Attention: The directory name has to end with the back-slash (\)

Select Directory:
Current Directory: C:\UDC\DATA\
New Directory : _
(only figures or capital letters)
(ENTER = Confirm)
(E = End)

Menu 5: Set or modify PC configuration

5.4 **Block check enable/disable**

This option is located in the backround and not shown on the screen !!

If Block check required please enable this calculation (key in 54) by changing this setting from 0 to 1 and confirm with Enter.

```
Block check off/on

Current setting : 0

New setting. _
                                    (0/1 = off/on)
                                    (ENTER = Confirm)
                                    (E      =  End    )
```

5.5 **Screen-color setting**

This option is located in the background and not shown on the screen !!

If it is required to change the screen color, key in 55 and the following screen appears.

actual color setting = 7,1
example text
example inverse

standard for monochrome = 7,0

fore-and background	foreground
color 0 black	color 8 grey
color 1 blue	color 9 bright blue
color 2 green	color 10 bright green
color 3 cyan	color 11 bright cyan
color 4 red	color 12 bright red
color 5 magenta	color 13 pink
color 6 brown	cololr 14 yellow
color 7 white	color 15 bright white

Input color foreground 0-15 (ESC=END)

Attention: If you choose the wrong combination the screen could be deactivated !!

Menu 5: Set or modify PC configuration

5.6 **Delay time**

This option is located in the background and not shown on the screen !!

If you want to optimise the transmitting delay time key in 56. Set faster (...4) or slower (...9) transmitting time and confirm with Enter, „Y“.

Remark: Don’t care about a beep during the transmission on the Miditron after you set the shortest delay time.

```
Delay time

        Current Delay time: 4

        New Delay time: _
        (4 - 9        )
        (ENTER = confirm)
                                        (E   = END)
                                        New Delay time:
                                        Save (Y/N):
```

Error Messages on the Miditron ® System

Please read the following notes:

The „Display“ selection: The kinds of output are enumerated. It is:

1. Error is displayed;
2. Error is displayed during initialisation phase;
3. Error is transmitted via back-up interface;
4. Error is assigned to respective test strip result;
5. Error is printed when service menu is entered;

Errors which are included in the data on the test strip results are displayed in the ERROR list („Check menu“) unless there is more than one error per test strip.

The „500-errors“ These are errors which can occur during test strip measurement. They indicate that the counts are outside a certain range. All results (from the reference area to test area 11) are tested for their so-called raw count limits. The test covers all possible wavelengths and both measuring heads. (In the worst case, one test strip can generate 12 x 6 = 72 errors).

Transferring the 500-errorsto the back-up interface:

When these count errors are transferred to the back-up interface, additional information, i.e. a code, is transferred together with the actual error number. The code contains information on the „color“ and area that fulfils the error conditions. It is transferred as a 4-digit number: xxyy wherein

xx = number of test area: 00 ... 12
yy = 00: measuring head 1; green; dark value;
yy = 01; measuring head 1; green bright value;
yy = 02; measuring head 1; orange dark value;
yy = 03; measuring head 1; orange bright value;
yy = 04; measuring head 1; red dark value;
yy = 05; measuring head 1; red bright value;
yy = 06; measuring head 2; green dark value;
yy = 07; measuring head 2; green bright value;
yy = 08; measuring head 2; orange dark value;
yy = 09; measuring head 2; orange bright value;
yy = 10; measuring head 2; red dark value;
yy = 11; measuring head 2; red bright value;

Incorrect positioning: There are 5 criteria to determine incorrect positioning of a test strip. The remission values resulting from the counts and the latest calibration data are used to detect incorrect positioning. All 66 measuring values of the test strip (11 test areas, 2 measuring heads, three colors each) are included in the analysis. This is the only check to which the resulting remission values are subject! The software does not execute any other scans of the remission value limits. It is possible that criteria 1 to 4 apply simultaneously to one test strip. If such a case occurs, the error numbers wil be „added up“. i.e. error number 610 is the sum of error numbers 602 and 608.

#	Description	Issue				
		1	2	3	4	5
	RAM-ERROR During power-up RAM write/read test is performed. Doing so the data in the RAM are not destroyed. If a memory cell is not writeable the beeprer on the CPU-motherboard rings two times and the software stops processing. On the display the message „Waiting for Power-up message“ appears. **Possible causes:** - RAM defective - CPU motherboard defective	Beeper rings 2 times				
	ERROR in internal Timer / Interrupt Controller During power-up an internal timer of the processor is tested. The counting function of the timer and the triggering of an interrupt are examined. If the timer does not work or the interrupt is not triggered the beeper on the CPU-motherboard rings three times and the software stops processing. On the display the message „Waiting for Power-up message“ appears. **Possible causes:** -Processor defective; - Interrupt controller defective; - CPU motherboard defective	Beeper rings 3 times				
0	**Non Specific Error** e.g. safety tracer not connected		X			X
1	**Emergency Halt** This message is prompted when the CLEAN-button is pressed or when the safety tracer is activated during motion or during an ongoing measurement. This error is no actual instrument malfunction but was prompted by faulty operation. The results of strips already pulled in the instrument but not yet completely measured will be ignored and marked with this error message.		X	X	X	X
2	**Motion Control Timeout** This error occurs only during an ongoing measurement. Some of the motions during an ongoing measurement are terminated by sensor signals (sensor interrupts). The respective motor then stops, the software, however, still executes the corresponding motion program. If this exceeds 255 ms, error 2 will be prompted. **Possible causes:** a: software error; irreparable; can be repaired be replacing the chip only b: the NMI-interrupt is disabled on the hardware			X	X	X
3	**Incorrect data in internal EEPROM** Incorrect data are detected in the EEPROM during the power up. In addition to user-specific settings (remission range border, interfaces, flag criteria, arbitrary units, user related text, language used, interface settings), these data also include calibration data. **Possible causes:** - Instrument switched off while data was being stored in EEPROM - EEPROM defective; - CPU motherboard defective; - External influences affecting the EEPROM **To eliminate error:** Check all above settings Note: In case of error, all ranges will be reset to factory settings (default values)		X			X

4	**Erroneous write access to internal EEPROM** The current written data set in the internal EEPROM is checked for correctness. Data contained in EEPROM is incorrect. A subsequent system boot will produce an error „3“ **Possible causes:** - Instrument switched off while data were being stored in the EEPROM - EEPROM defective; - CPU motherboard defective; - External influences affecting EEPROM To eliminate error: Turn off instrument	X				X
5	**Battery low** The battery voltage is less than 2.6 V. The battery should be exchanged in the next few weeks.	X				
50	**Error occurring during calibration** Impossible to determine a PGA value. This concerns the green LED in measuring head 1: Difference (bright counts-dark counts) is not at 2200 +/- 149. **Possible causes:** - LED is defective or not connected - Spectral response of LED not ok - Photo detector is defective or not connected - Reference area in instrument is contaminated - Surrounding light - cable between measuring head and CPU motherboard is defective - Defective electronics hardware; pre-amplifier of amplifier settings	X		X		X
52	**Error occuring during calibration** Impossible to determine a PGA value. This concerns the red LED in measuring head 1: No difference (bright counts-dark counts) at 2200+/- 149 **Possible causes:** - LED is defective or not connected - Spectral response of LED not ok - Photo detector is defective or not connected - reference area in instrument is contaminated - Surrounding light - Cable between measuring head and CPU motherboard is defective - Defective electronics hardware: pre-amplifier or amplifier settings	X		X		X
53	**Error occurring during calibration** Impossible to determine a PGA value. This concerns the green LED in measuring head 2: No difference (bright counts-dark counts) at 2200+/- 149 **Possible causes:** - LED is defective or not connected - Spectral response of LED not ok - Photo detector is defective or not connected - Reference area in instrument is contaminated - Surrounding light - Cable between measuring head and CPU motherboard is defective - Defective electronics hardware: pre-amplifier or amplifier settings	x		X		X

54	**Error occurring during calibration** Impossible to determine a PGA value. This concerns the orange LED in measuring head 2: No difference (bright counts-dark counts) at 2200 +/- 149 **Possible causes:** - LED is defective or not connected - Spectral response of LED not ok - Photo detector is defective or not connected - Reference area in instrument is contaminated - Surrounding light - Cable between measuring head and CPU motherboard is defective - Defective electronics hardware: pre-amplifier or amplifier settings	X		X		X
55	**Error occurring during calibration** Impossible to determine a PGA value. This concerns the red LED in measruing head. 2: No difference (bright counts-dark counts) at 2200 +/-149 **Possible causes:** - LED is defective or not connected - Spectral response of LED not ok - Photo detector is defective or not connected - Reference area in instrument is contaminated - Surrounding light - Cable between measuring head and CPU motherboard is defective - Defective electronics hardware: pre-amplifier or amplifier settings	X		X		X
57	**Error occurring during calibration** Impossible to determine a PGA value. At least one of the 6 PGA values was found to be smaller than 16. This is not acceptable since it may result in unacceptable amplification by the pre-amplifier. **Possible causes:** - Photo detector is defective or not connected - Reference area in instrument is contaminated - Surrounding light - Cable between measuring head and CPU motherboard is defective - Defective electronics hardware: pre-amplifier or amplifier settings.	X		X		X
80	**Error occurring during calibration** At least one of 72 calculated remission values (areas 0 10 11, two measuring heads, three LEDs each) is outside the tolerance limit. In case of user-calibration: Cal_Value < o.9 * Soll_EXT **Possible causes:** - Photo detector is defective or not connected - Reference area in instrument is contaminated - Calibration strip is incorrectly positioned - Surrounding light	X		X		
81	**Error occurring during calibration** At least one of 72 calculated remission values (areas 0 to 11, two measuring heads, three LEDs each) is outside the tolerance limit. In case of user-calibration : Cal_Value<0.9 * SOLL_EXT **Possible causes:** - Photo detector is defective or not connected - Reference area in instrument is contaminated - Calibration strip is incorrectly positioned - Surrounding light	X		X		
82	**Error occurring during calibration** In case of user-calibration with the first test-strip the following value is found: ABS (DIFFERENCE(Cal_Value-SOLL_EXIT)<1% This is not an actual instrument malfunction but a reaction acceptable in routine operation of the customers. A second strip is requested.	X		X		

83	**Error occurring during calibration** At least one of 72 calculated remission values (areas 0 to 11, two measuring heads, three LEDs each) is outside the tolerance limit. In case of manufacturer-calibration: Cal_Value<0.9 * SOLL_EXT **Possible causes:** - Photo detector is defective or not connected - Reference area in instrument is contaminated - Calibration strip is incorrectly positioned - Surrounding light	X		X		
84	**Error occurring during calibration** At least one of 72 calculated remission values (areas 0 to 11, two measuring heads, three LEDs each) is outside the tolerance limit. In case of manufacturer-calibration: Cal_Value>1.1 * SOLL_EXT **Possible causes:** - Photo detector is defective or not connected - Reference area in instrument is contaminated - Calibration strip is incorrectly positioned - Surrounding light	X		X		
85	**Error occurring during calibration** A check of the AD-converter counts of the calibration strip has revealed that the values either exceeded or fell below the given limits. **Possible causes:** - LED is defective or not connected - Spectral response of LED not ok - Photo detector is defective or not connected - One or more areas of the calibration strip are contaminated - Cable between measuring head and CPU motherboard is defective - Defective electronics hardware: pre-amplifier or amplifier settings - Calibration strip is incorrectly positioned - Surrounding light	X		X		
101	**Motion Error** The sensor „measuring head“ does not indicate the condition expected after a motion into reference position: **Possible causes:** - Light barrier is defective or not connected or contaminated - Sensor signal does not arrive at CPU - Mechanical problem: sluggish movement - Stepping motor does not move		X	X	X	X
103	**Motion Error** The „Tray desk crude“ sensor does not indicate the condition expected. This error can occur during an ongoing measurement, particularly after the first partial elevating motion (tray desk down) of the measuring-motion-cycle and when the transport plate is subsequently to be moved in the so-called strip-accept position. In this position, however, the „tray desk crude“ sensor is unexpectedly covered after the first travelling motion. It is to be expected that the MIDITRON system is malfunctioning. **Possible causes:** - Light barrier defective/not connected - Sensor signal does not arrive at CPU - Mechanical problem: sluggish movement - Stepping motor does not turn		X	X	X	X

104	**Motion Error** The „transport plate fine“ sensor does not indicate the condition expected after a motion into reference position. In this case the sensor erroneously indicates the condition „free“ during motion # 24 (transport plate 80 half steps into reference position). **Possible causes:** - Light barrier is defective or not connected - Sensor signal does not arrive at CPU - Mechanical problem: sluggish movement - Stepping motor does not turn		X	X	X	X
105	**Motion Error** The „transport plate identification“ sensor does not indicate the condition expected. This error can occur a.: when the transport plate has moved from strip-insert-position 1 back to strip-insert-position 2;-> the light barrier is not covered. b.: when the transport plate has moved into strip-insert-position 1; -> sensor is not covered. c.: after motion in the reference moving cycle; the instrument attempted to execute a reference motion of the tray desk. Prior thereto, however, the system detected that the sensor is erroneously covered and that the transport plate is hence not positioned properly. **Possible causes:** - Light barrier is defective or not connected - Sensor signal does not arrive at CPU - Mechanical problem: sluggish movement - Stepping motor does not turn		X	X	X	X
123	**Motion Error in motion # 3** A sensor signal did not arrive or was delayed. The related motion is „transport plate move from strip-insert-position 1 back into position 2“. **Possible causes:** - Light barrier is defective or not connected - Sensor signal does not arrive at CPU - Mechanical problem: sluggish movement - Stepping motor does not turn - Measuring unit is maladjusted - Mechanical problems with bearing tolerance		X	X	X	X
125	**Motion Error in motion # 5** A sensor signal did not arrive or was delayed. The related motion is „transport plate move from strip-insert-position 1 back into position 2“. **Possible causes:** - Light barrier is defective or not connected - sensor signal does not arrive at CPU - Mechanical problem: sluggish movement - Stepping motor does not turn - Measuring unit is maladjusted - Measuring problems with bearing tolerance		X	X	X	X
129	**Motion Error in motion # 9** A sensor signal did not arrive or was delayed. The related motion is „Measuring head back from test area 12“. **Possible causes:** - Light barrier is defective or not connected - Sensor signal does not arrive at CPU - Mechanical problem: sluggish movement - Stepping motor does not turn - Measuring unit is maladjusted - Mechanical problems with bearing tolerance		X	X	X	X

130	**Motion error in motion #10** A sensor signal did not arrive or was delayed. The related motion is "tray desk halfway down". **Possible causes: Light barrier is defective or not connected** - Sensor signal does not arrive at CPU - Mechanical problem: sluggish movement - Stepping motor does not turn - Measuring unit is maladjusted - Mechanical problems with bearing tolerance		X	X	X	X
133	**Motion error in motion #13** A sensor signal did not arrive or was delayed. The related motion is "tranport plate back into reference position". **Possible causes**: - Light barrier is defective or not connected - Sensor signal does not arrive at CPU - Mechanical problem: sluggish movement - Stepping motor does not turn - Measuring unit is maladjusted - Mechanical problems with bearing tolerance		X	X	X	X
134	**Motion error in motion #14** A sensor signal did not arrive or was delayed. The related Motion is "Search for transport plate when executing the reference motion cycle of the transport plate". **Possible causes**: - Light barrier is defective or not connected - Sensor signal does not arrive at CPU - Mechanical problem: sluggish movement - Stepping motor does not turn - Measuring unit is maladjusted - Mechanical problems with bearing tolerance		X	X	X	X
135	**Motion error in motion #15** A sensor signal did not arrive or was delayed. The related motion is "tranport plate back into reference position" **Possible causes**: - Light barrier is defective or not connected - Sensor signal does not arrive at CPU - Mechanical problem: sluggish movement - Stepping motor does not turn - Measuring unit is maladjusted - Mechanical problems with bearing tolerance		X	X	X	X
136	**Motion error in motion #16** A sensor signal did not arrive or was delayed. The related motion is "Move tray desk from CLEAN position up into reference position". **Possible causes**: - Light barrier is defective or not connected - Sensor signal does not arrive at CPU - Mechanical problem: sluggish movement - Stepping motor does not turn - Measuring unit is maladjusted - Mechanical problems with bearing tolerance		X	X	X	X

137	**Motion Error in motion # 17** A sensor signal did not arrive or was delayed. The related motion is „Search reference position for tray desk during measurement“. **Possible causes:** - Light barrier is defective or not connected - Sensor signal does not arrive at CPU - Mechanical problem: sluggish movement - Stepping motor does not turn - Measuring unit is maladjusted - Mechanical problems with bearing tolerance		X	X	X	X
139	**Motion Error in motion # 19** A sensor signal did not arrive or was delayed. The related motion is „Measuring head back into reference position“. **Possible causes:** - Light barrier is defective or not connected - Sensor signal does not arrive at CPU - Mechanical problem: sluggish movement - Stepping motor does not turn - Measuring unit is maladjusted - Mechanical problems with bearing tolerance		X	X	X	X
141	**Motion Error in motion # 21** A sensor signal did not arrive or was delayed. The related motion is „Measuring head advances passing the light barrier into reference position to complete a measurement cycle.“ **Possible causes:** - Light barrier is defective or not connected - Sensor signal does not arrive at CPU - Mechanical problem: sluggish movement - Stepping motor does not turn - Measuring unit is maladjusted - Mechanical problems with bearing tolerance		X	X	X	X
142	**Motion Error in motion # 22** A sensor signal did not arrive or was delayed. The related motion is „Transport plate in reference position“. **Possible causes:** - Light barrier is defective or not connected - Sensor signal does not arrive at CPU - Mechanical problem: sluggish movement - Stepping motor does not turn - Measuring unit is maladjusted - Mechanical problems with bearing tolerance		X	X	X	X
153	**Step monitoring was activated (during measuring cycle)** Stepping motor # 2 (transport plate) lost more than 10 steps between the beginning of the measuring cycle and completion of the total cycle. **Possible causes:** - Mechanical problem: sluggish movement - Stepping motor does not turn - Measuring unit is maladjusted - Mechanical problems with bearing tolerance		X	X	X	X
167	**Step monitoring was activated (during measuring cycle).** Stepping motor # 1 (tray desk) lost more than 5 steps between the beginning of the measuring cycle movement and completion of the total cycle. **Possible causes:** - Mechanical problem: sluggish movement - Stepping motor does not turn - Measuring unit is maladjusted, Mech. problems with bearing tolerance					

171	**Step monitoring was activated (during measuring cycle)** Stepping motor # 3 (measuring head) lost more than 5 steps between the beginning of the measuring cycle and completion of the total cycle. **Possible causes:** _ Mechanical problem: sluggish movement - Stepping motor does not turn - Measuring unit is maladjusted - Mechanical problems with bearing tolerance		X	X	X	X
200	**Combination of motion Error and/or Sensor Error.** The number of interrupts of the time control light barrier of the tray desk drive does not match the number expected. This scan occurs during the measuring cycle. **Possible causes:** - after motion „Elevator table 1738 half steps downward“ (expected number of interrupts was 8) - after motion „Elevator table 674 half steps upward“ (expected number of interrupts was 3) - after motion „Elevator table 579 half steps upward“ (expected number of interrupts was 3) Possible causes: - Mechanical problem: sluggish movement - Stepping motor does not turn - Measuring unit is maladjusted - Mechanical problems with bearing tolerance		X	X	X	X
301	**Printer Error** Internal printer is basically ready, however, paper is not in TOF position. Keep line feed key on operator unit M pressed for a few seconds. Operator error.	X				
302	**Printer Error** Internal printer is not ready; printer head is overheated. Wait and allow to cool down. If error occurs again call technical service.	X				
303	**Printer Error** Internal printer is not ready; printer head is not warm enough. Heater in printer may be defective. If error occurs again call technical service.	X				
304	**Printer Error** Paper out. Supply new paper. Operator error	X				
305	**Printer Error** Printer head drawn back. Operator error.	X				
306	**Printer error** TOF mark not detected. Not-BM-paper in use or paper inserted back to front. Operator error.	X				
307	**Printer error** 24-V Power supply fail. Service call necessary	X				
308	**Printer error** Data transmission to the internal printer failed by time-out. Connection CPU versa printer possibly broke down. Service call necessary.	X				
309	**Printer error** Data transmission to the internal printer failed. The data format (e.g. baud rate) is wrong. Connection disabled. Service call necessary.	X				

531	**Error during test strip measurement** AD-converter counts are outside certain ranges. Bright value > 6000.	X				
532	**Error during test strip measurement** AD-converter counts are outside certain ranges. Dark value > 2000.			X	X	
533	**Error during test strip measurement** AD-converter counts are outside certain ranges. Dark value < 500.			X	X	
534	**Error during test strip measurement** AD-converter counts are outside certain ranges. Difference (Bright count-dark count) > 3700.			X	X	
535	**Error during test strip measurement** AD-converter counts are outside certain ranges. Difference (Bright count-dark count > 40 or dark count > bright count)			X	X	
601 to 615	**Notes regarding errors related to incorrect positioning:** Errors 601, 602, 604, and 608 are linked: this means if error 614 occurs, errors 602, 604 and 608 will also occur on the same strip („14“=„2“+“4“+“8“). In this case the system will display error number 614 and only 1 error will be registered in the ERROR-count. If 5 consecutive test strips are incorrectly positioned the analyser opens automatically			X	X	
601	**Incorrect positioning criterion 1: any remission value is < 1.2 %** Paper out. Supply new paper. Operator error			X	X	
602	**Incorrect positioning criterion 2: The following applies:** a1 = (remission compensation area green measuring head 1) b1 = (remission compensation area green measuring head 2) a2 = (remission compensation area orange measuring head 1) b2 = (remission compenation area orange measuring heasd 2) a3 = (remission compensation area red measuring head 1) b3 = (remission compensation area red measuring head 2) a4 = (remission density area green measuring head 1) b4 = (remission density area green measuring head 2) a5 = (remission density area orange measuring head 1) b5 = (remission density area orange measuring head 2) a6 = (remission density area red measuring head 1) b6 = (remission density area red measuring head 2) a7 = (remission pH area green measuring head 1) b7 = (remission pH area green measuring head 2) a8 = (remission pH area orange measuring head 1) b8 = (remission pH area orange measuring head 2) a9 = (remission pH area red measuring head 1) b9 = (remission pH area red measuring head 2) Va = alxal + a2xa2+...+a9xa9 A=SQRT (Va) Vab = (al-b1)x(al-b1)+(a2-b2)x(a2-b2)+...+(a9-b9x(a9-b9) A-B=SQRT (Vab) The following must apply then: A-B / A is smaller than 0.11			X	X	
604	**Incorrect positioning criterion 3:** Remission values must have a minimum value. 66 individual minimum remission values are checked. An error message is generated if one of these values is not reached.			X	X	
608	**Incorrect positioning criterion 4:** The remission values of one colour of one measuring head at the compensation area fall below 38.039%			X	X	

616	**Incorrect positioning criterion 5:** The remission values of the test area A10G (measuring head 1; parameter: pH; green LED) or B10G (measuring head 2; parameter: pH; green LED) are greater than 63%. **Possible causes**: - Test strip lies upside down - Test strip is dry - Calibrations strip is used instead of test strip - Note: Incorrectly positioned test strips according to criterion 5 do not result in an opening of the device.			X	X	
666	**Detection of cable damage** Cable damage has occurred or is imminent. This concerns the cable connecting the CPU to the measuring heads. If more than 21 strips have been measured in one series, then the detection mode for cable damage will be activated. A floating mean of the measuring values is monitored for bounces. Beginning damage at a cable should then be indicated by "unstable" measuring values of the unchanged reference area. If the difference (reference area bright counts - reference area dark counts) deviates from the average of the last 20 differences by more than 100 counts, a 666 error is generated. **Possible causes**: - Imminent cable damage. Call technical service if such damage occurs frequently.			X	X	

symptom	assembly group		assembly-part	Error-#
unspecific error	obs.			0.1
mispositioning of the chem. strip				601 to 615, 616
obs.	Printer			301, 302, 303, 304, 305, 306, 307, 308, 309
	electronical hardware		EEPROM	3,4
			NMI-Interrupt	2
			RAM	2 Beeps
			Timer/Interrupt Controller	3 Beeps
			Battery	5
	optical hardware		general	57,80,81,82,83,84,85, 531,532,533,534,535
			measuring head 1; green LED	50
			measuring head 1; orange LED	51
			measuring head 1; green LED	52
			measuring head 2; green LED	53
			measuring head 2; orange LED	54
			measuring head 2; red LED	55
	mechanical hardware	tray desk	general	130,136,137, 167,200
			light barrier	103
		measuring head	general	101,129,139,141,171
			cable to measuring head	666
		transport plate	general	123,125,133,134,135, 142,153
			light barrier raw	104
			light barrier fine	105

1. Overview

This Manual contains information relating to the signal form and protocol (communication rules) for the connection of the Miditron system to an external computer (hereafter referred to as a Host) via asynchronous serial signal. The data exchange is semiduplex; the operation takes place in a point to point connection. The Miditron device is the master at all times. Only ASCII symbols are transmitted according to DIN 66003 (hexadecimal values between 01 and 7F) **The activation of the host interface can and must only become effective after a power-off/on at the Miditron device.**

Download

The following effective data are received by the Miditron from the host computer:
Patient identification consisting of ten ASCII symbols, which characterise the test to be evaluated. For security reasons, Miditron checks each Pat-ID received with the one received immediately prior to it; if agreement is detected, then one of the two is rejected Miditron internally. After a certain time, a service list is stored in the device internally- Pat-IDs can also be shifted during measurements so long as results exist internally for all Pat-IDs, or until the service list contains 270 Pad-IDs (300 strip limit minus a 10% for possible emergency tests).

After a specific time of no response, the Miditron starts a time-window of non communication, the so-called auto polling time, (length of the time-window depends on the device setting). After the auto polling time is elapsed, the Miditron keeps starting a new cycle of the down-load data request. Should a download occur just when the customer activates an up-load process, then the Miditron memorises this and after completion of the down-load, automatically starts with the up-load.l

The Pat-IDs are limited in their set of symbols until the device software version 3.0 is issued: At present, only numerical characters between 30 hex (0) and 39 hex (9) are admissible!

UPLOAD

The following data are put out by the Miditron :
Date, time of measurement, evaluations obtained from the urine test strips, visually obtained evaluations, density values obtained by external means, patient identification numbers, and also the sequence numbers to facilitate co-ordination, as well as customer-specific text and settings . We distinguish between short protocols (test strip evaluations only) and long protocols (incl. sediment evaluations), as well as between transmission of the results in code (concentration levels, up-load I), and in plain text (up-load II).

Coded evaluations require decoding at the host side. For this, the host must know the corresponding table "concentration level to value and unit". It is able to request it, if necessary. Also other device settings can be called, as e.g. customer-specific limits, arbitrary units and screening criteria; the so-called operation control protocol (OPC) contains precisely this information.

The Miditron analyses the status of the communication. It measures the responding times of the host, and it checks the parity (optional), the LRC check bytes (optional), and the frame characteristic of the responses. No erroneous protocol is accepted.
An up-load in sequence mode after measurement is also possible as well as in Pat-ID mode. In case of a sequence mode evaluation, the data field of Pat-ID consists only of spaces.

2. Hardware Specification

2.1 Chip Description

The Miditron M-UKART (universal asynchronous receiver/transmitter) is the SCN2681 chip. The interactive unit consistsof the 1488 chip as a line driver and of the 1489 chip as a line receiver.

2.2 Pin description at the Miditron M socket

Socket: RS232C9-pin (male)

Pin No.d	Signal	Description	Direction
1	nc	non connected	
2	RxD	Receive Data	in
3	TxD	Transmit Data	out
4	nc	non connected	
5	SG	Signal Ground	-
6	nc	non connected	
7	RTS	Request to Send	out
8	CTS	Clear to Send	in
9	nc	non connected	

Comments:

The RTS signal of the Miditron M is not active (Mark) all the time.

This signal is only useful for checking at the Host side if a physical connection is established.

2.3 Recommended cable connection

Miditron M (DTE)	plug 9 pin female	direction	plug 9 pin female	plug 25 pin female	HOST (DTE)
	pin 1		pin 1	pin	
RxD	pin 2	<--------	pin 3	pin 2	TxD
TxD	pin 3	--------->	pin 2	pin 3	RxD
	pin 4		pin 4	pin	
GND	pin 5	<-------->	pin 5	pin 7	GND
	pin 6		pin 6	pin	
RTS	pin 7		pin 7	pin	
CTS	pin 8		pin 8	pin	
	pin 9		pin 9	pin	

3. Text format

Each transmitted protocol is sent as a block. Blocks of Host- and Miditron texts are structured according to the same scheme:

3.1	3.2	3.3	3.4	3.5	3.6
start character	**frame field**	**data field**	**stop character**	**check sum**	**end character**

3.1 Start character

Each transmitted text begins with the start character „STX“ and is 1 byte long.
The hex. code of „STX“ is 02 hex and the ASCII character is ☺.

start character
1 byte
STX
02 hex
☺

3.2 Frame field

The frame field represents the purpose of text (contents of message) and consists of the frame code, function code and space.

frame field		
frame code	function code	space
1 byte	1 byte	1 byte
SPE, SPM, ANY, REP, MOR, OPC, END	A...U	SP
(3B, 3C, 3E, 3F, 3E, 3D, 3A) hex	41 hex...55hex	20 hex
; < > ? > = :	A...U	‘

3.2.1 Frame code types:

frame code	HEX	ASCII	description
SPE	3B	;	response/confirmation from Miditron of Host to continue UP-or Down-Load
SPM	3C	<	ready for UP-Load data transmission
ANY	3E	>	start and confirmation of Down-Load date
REP	3F	?	replay of last transmitted data
MOR	3E	>	request for more UP-Load data
OPC	3D	=	request for instrument setting data
END	3A	:	stop of UP.Load

3.2.2 Function code types

function code	HEX	ASCII	description
A	41	A	only used by down-loading (request for samples)
B	42	B	Protocol I: Test strip results only (coded)
B	42	B	Protocol I: Test strip results + Sediment results (coded)
C	43	C	Protocol II/I: Test strip/Sediment results Part 2 (Sedi + Appearance)
D	44	D	Protocol II/II: test strip/Sediment results Pat 2 (Sedi + Appearance
E	45	E	Protocol II: Test strip results only
F	46	F	Protocol II: Test strip results (no Sediment results existing)
G	47	G	OPC: request for ranges of SG
H	48	H	OPC: request for ranges of PH
I	49	I	OPC: request for ranges of LEU
J	4A	J	OPC: request for ranges of NIT
K	4B	K	OPC: request for ranges of PRO
L	4C	L	OPC: request for ranges of GLU
M	4D	M	OPC: request for ranges of KET
N	4E	N	OPC: request for ranges of UBG
O	4F	O	OPC: request for ranges of BIL
P	5O	P	OPC: request for ranges of ERY
Q	51	Q	OPC: request for additional use test field
R	52	R	OPC: request for the first 15 sediment texts
S	53	S	OPC: request for the second 15 sediment texts
T	54	T	OPC: request for Screening criteria
U	55	U	OPC: request for other instrument information and settings

3.3 Data field

The Data field consists of the information of Pat. ID, Seq. No., date, time and results.

Data Field				
Pat-ID	Seq.No.	Date	Time	Results
10/11 byte	6 byte	9 byte	6 byte	62...705 byte
0...9/+SP	0...9 + SP	0...9 + SP	0...9 + SP	0...9
(30...39/+20) hex	(30...39+20) hex	(30...39+20) hex	(30...39 + 20) hex	(30...39) hex

3.3.1 Pat.ID

Upload:
The Patient ID contains 11 numeric characters including a space which is transmitted left hand oriented. If no Pat. ID is given this field contains only spaces.

Download:
This is the only information (without an additional space) which is transmitted from Host.

Example: Pat.ID.: 978445

Pat. ID										
9	7	8	4	4	5	SP	SP	SP	SP	SP

3.3.2 Sequence Number

The sequence number is generated on Miditron and transmitted to the host in case of upload.

Example: Sequence number 137

Seq. No.					
1	3	7	SP	SP	SP

3.3.3 Date

This is the date of test strip measuring.
The date format depends on the activated form on the Miditron.

Example: 17.07.92

Date								
1	7	.	0	7	.	9	2	SP

3.3.4 Time

This is the time of test strip measuring.
The time format depends on the activated form on the Miditron

Example: 14:35

Time					
1	4	:	3	5	SP

3.3.5 Results

The length and the information of the result field depend on the transmitted function code in the frame field (see also chapter 3.2.2).

Table of the different result field lengths

function code	B	B	C	D	E	F	G...O	R...S	T	U
length of result in byte (max.)										

Examples of result fields:

(the character „/“ means only a separation of contents and is not transmitted)

function code B:
(code results)

byte 37... 41 length : 5 ▪1|▪6|▪| (SG, 1.030)
byte 42... 46 length : 5 ▪2|▪1|▪| (PH, 6.0)
byte 47... 51 length : 5 ▪3|▪0|▪| (LEU, neg)
byte 52... 56 length : 5 ▪4|▪0|▪| (NIT, neg)
byte 57... 61 length : 5 ▪5|▪1|▪| (PRO, 0.25g/l)
byte 62... 66 length : 5 ▪6|▪0|▪| (GLU, norm)
byte 67... 71 length : 5 ▪7|▪0|▪| (KET, neg)
byte 72... 76 length : 5 ▪8|▪0|▪| (UBG, norm)
byte 77... 81 length : 5 ▪9|▪0|▪| (BIL, neg)
byte 82... 86 length : 5 10|▪0|▪| (ERY, neg)
byte 87... 91 length : 5 11|▪▪|▪| (NAG, ---)
byte 92... 98 length : 7 50|*| (external SG) optional

function code B:
Data transmitted in numeric code, means each testpad and each range have a specific number (coded results).

byte 37... 41 length : 5 ▪1|▪6|▪|
byte 42... 46 length : 5 ▪2|▪1|▪|
byte 47... 51 length : 5 ▪3|▪0|▪|
byte 52... 56 length : 5 ▪4|▪0|▪|
byte 57... 61 length : 5 ▪5|▪1|▪|
byte 62... 66 length : 5 ▪6|▪0|▪|
byte 67... 71 length : 5 ▪7|▪0|▪|
byte 72... 76 length : 5 ▪8|▪0|▪|
byte 77... 81 length : 5 ▪9|▪0|▪|
byte 82... 86 length : 5 10|▪0|▪|
byte 87... 91 length : 5 11|▪▪|▪|
byte 92... 96 length : 5 12|▪4|▪| (example of sediment result) optional

. (sediment results max.10x) only transmitted when available
.
byte 135...148 length : 4 41|▪4|▪| (example of sediment result) optional

function code C, E, F:
part I (test strip results)

byte 37... 49 length : 13 SG|▪▪▪▪▪|▪|▪▪▪▪|▪|
byte 50... 60 length : 11 PH|9.0|▪|++++|▪|
byte 61... 80 length : 20 LEU|▪▪▪▪▪▪▪▪neg|▪|NEG|▪|
byte 81... 92 length : 12 NIT|pos|▪|▪▪▪▪|▪|
byte 93...112 length : 20 PRO|▪▪▪25▪mg/dl|▪|▪TR▪|▪|
byte 113...132 length : 20 GLU|▪▪▪50▪mg/dl|▪|▪▪+▪|▪|
byte 133...152 length : 20 KET|▪▪▪▪▪▪▪▪neg|▪|▪▪▪▪|▪|
byte 153...172 length : 20 UBG|▪▪▪▪▪▪▪▪norm|▪|NORM|▪|
byte 173...192 length : 20 BIL|▪▪▪▪▪▪▪▪neg|▪|▪NEG|▪|
byte 193...212 length : 20 ERY|▪▪▪▪▪▪▪▪neg|▪|▪▪-▪|▪|
byte 213...232 length : 20 NAG|▪▪▪▪▪▪▪▪▪▪▪▪|▪|▪▪▪▪|▪|
byte 233...242 length : 10 phySG|1.030| optional

function code D:
part II (sediment results) example

byte 37... 55 length : 19 ERY▪▪▪▪▪▪▪|++▪▪▪▪▪▪|▪|
byte 56... 74 length : 19 LEUCO▪▪▪▪▪|FEW▪▪▪▪▪|▪|
.
. (sediment results max. 10x) only transmitted when available
.
byte 209...226 length : 19 ▪▪▪▪▪▪▪▪▪▪|▪▪▪▪▪▪▪▪|▪|

3.4 OPC-function codes G...U (Operation Control)

example of OPC protocols „G...O“ Miditron/Host:

HOST

Byte No.	length	meaning	example
1	1	start character	STX
2	1	frame code	OPC
3	1	function code	G
4	1	space	SP
5	1	stop character	ETX
6...7	2	check sum	(LRC1 LRC2)
8	1	end character	CR

Miditron

Byte No.	length	meaning	example
1	1	start character	STX
2	1	frame code	OPC
3	1	function code	G
4	1	space	SP
5	1	mark	*
6...13	8	date	12:07:92
14	1	space	SP
15...19	5	operator ID	123
20	1	space	(
21...23	3	parameter name	(SG
24...25	2	index of concentration level	(0
26	11	text of concentration level	((((((1.000
27...30	4	text of arbitrary level	((-(
31	1	index of arbitrary level	1
32	1	stop character	ETX
33...34	2	check sum	(LRC1, LRC2)
35	1	end character	CR

byte 24 5o 31 max. 28 times repeated

example of OPC protocols "R, S" Miditron :

			example
byte	01... 01	length : 1	(STX)
byte	02... 02	length : 1	=
byte	03... 03	length : 1	R
byte	04... 04	length : 1	▪
byte	05... 56	length :52	12|ERYTROZYT.|5-10▪▪▪▪|11-20▪▪▪|21-30▪▪▪| >30▪▪▪▪▪|▪▪▪▪▪▪▪▪|
.			
.	13 x		
.			
byte	733...784	length :52	26|▪▪▪▪▪▪▪▪▪▪|▪▪▪▪▪▪▪▪|▪▪▪▪▪▪▪▪|▪▪▪▪▪▪▪▪|▪▪▪▪▪▪▪▪| ▪▪▪▪▪▪▪▪|
byte	785...785	length : 1	(ETX)
byte	786...786	length : 1	(LRC1)
byte	787...787	length : 1	(LRC2)
byte	788...788	length : 1	(CR)

example of OPC protocol "T" Miditron :

			example
byte	01... 01	length : 1	(STX)
byte	02... 02	length : 1	=
byte	03... 03	length : 1	T
byte	04... 04	length : 1	▪
byte	05... 12	length : 8	▪1|▪0|▪2|1|▪|
.			
.	13 x		
.			
byte	85... 92	length : 7	11|▪0|55|0|▪|
byte	93... 93	length : 1	(ETX)
byte	94... 94	length : 1	(LRC1)
byte	95... 95	length : 1	(LRC2)
byte	96... 96	length : 1	(CR)

example of OPC protocol "U" Miditron :

			example
byte	01... 01	length : 1	(STX)
byte	02... 02	length : 1	=
byte	03... 03	length : 1	U
byte	04... 04	length : 1	▪
byte	05... 31	length :27	BOEHRINGER▪MANNHEIM▪GmbH▪▪|▪|
byte	32... 83	length :52	0|4|1|2|0|1|2|1|0|4|1|2|▪|1|0|▪|▪2.3▪|▪1.30|▪7.4▪|▪|010| ▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪|
byte	84... 84	length : 1	(ETX)
byte	85... 85	length : 1	(LRC1)
byte	86... 86	length : 1	(LRC2)
byte	87... 87	length : 1	(CR)

3.5 LRC calculation

The LRC test bytes are in the nature of a longitudinal redundance check. It is a so called "length parity" over the bits of the data protocol. The procedure is simple: byte for byte of the protocol is gradually linked with XOR. The resulting byte is split into two bytes (for the purpose of avoiding the occurrence of transmission controls), and attached to the protocol.

LRC-byte = byte 1 XOR byte 2 XOR byte3 ... XOR byte last

LRC1-byte = high-nibble (moved by 4 bits) of the LRC byte OR 30 *hex*
LRC2-byte = low-nibble of the LRC byte OR 30 *hex*

example:

byte no.	bit no.	bit no.	bit no.	bit no.	bit no.	bit no.	bit no.	bit no.
	8	7	6	5	4	3	2	1
1	0	1	1	0	0	0	1	0
2	0	0	0	0	0	0	1	1
3	0	0	1	1	0	1	1	0
4	0	0	1	1	1	0	1	0
5	0	0	1	1	1	1	1	0
LRC byte	0	1	0	1	0	0	1	1
high nibble	0	1	0	1				
low nibble					0	0	1	1

LRC1-byte =	0	0	1	1	0	0	0	0	30 *hex*
OR	0	0	0	0	0	1	0	1	high-nibble
	0	0	1	1	0	1	0	1	

LRC2-byte =	0	0	1	1	0	0	0	0	30 *hex*
OR	0	0	0	0	0	0	1	1	low-nibble
	0	0	1	1	0	0	1	1	

All bytes starting with STX to ETX are taken into account for the calculation of the LRC.
Is the parity check deactivated instead of the LRC check bytes, LRC1=LRC2=20*hex*=blank will be transmitted!

4. Signal Description

4.1 Setting of Miditron Host-interface

item	specification	default
parity	even, odd, none	none
baud rate	1200, 2400, 4800, 9600	9600
stop bits	1, 2	1
bits / char.	7, 8	8
protocol	encoded, long form	encoded
check sum	on, off	off
autopolling interval in minutes	0.5, 1, 3, 5	0.5

Remark: Autopolling from 3.0 o.5 min. !!!

4.2 Signal discrimination

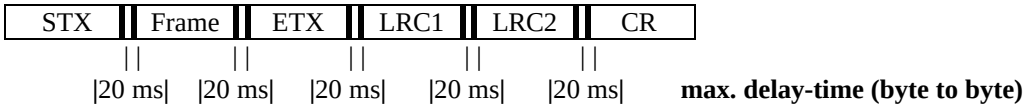
Signal	Binary	Level	RS232 Voltage
Mark (OFF)	logic "1"	low	<= - 3V
Space (ON)	logic "0"	high	< +3V

4.3 Signal timing

4.3.1 Down Load

a)

Miditron :



b)

response time Host : 15 sec. max. then autopulling pause.

c)

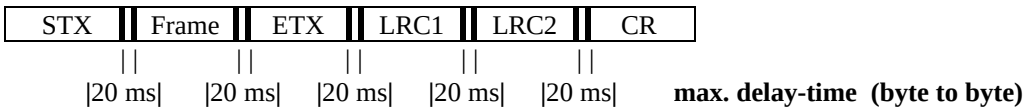
Host :

STX	Frame	F-Code	Space	ID No	ETX	LRC1	LRC2	CR

|<----------max. transmitting time : **1.5 sec.**----------|

d)

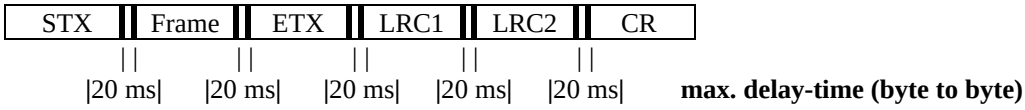
Miditron :



4.3.2 Up Load

a)

Miditron:



b)

response time Host : 15 sec. max.

repeat Miditron string (a) max. 3 times then stop Up-Load

c)

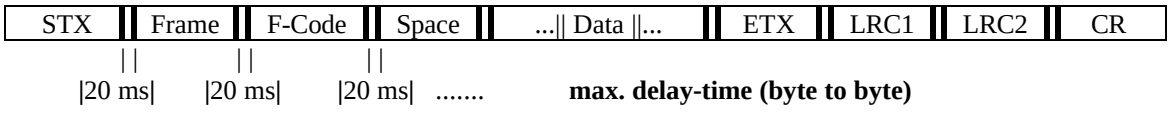
Host :

STX	Frame	(F-Code)	(Space)	ETX	LRC1	LRC2	CR

|<----------max. transmitting time : **1.5 sec.**----------|

d)

Miditron:



Explosion drawings of Miditron instrument

Explanation of position numbers.

No.	Part name	ID No:
1.	Upper casing	1402129
2.	Side flap	1402145
3.	Hinge set for side flap	1402170
4.	Keyboard	1401785
5.	Display shield	1402169
6.	Display	1401893
7.	Paper guiding printer	1403915
8.	Synchronmotor board	1401777
9.	Program card	1402nnn
10.	CPU-Board	1401769
11.	Power supply unit	1401726
12.	Power supply distribution board	1401742
13.	Power supply filter	1401734
14.	Fan 1	1401882
15.	Bottom housing	1402137
16.	Manual crank	1402153
17.	Front flap	1402153
18.	Hinge sets for front flap	1402162
19.	Measuring module	1402102
20.	Measuring head board (1/2)	1402315
21.	Measuring head cover	
22.	Printer (with fan 2)	1401904
23.	Contact ledge (Finger sensor)	
24.	Contact switch with exception	1401955
25.	Rubber blanking for manual crank	1402200

Explosion drawings of Miditron measuring unit

Explanation of position numbers.

No.	Part name	ID No:
1.	Measure	
2.	LB 4, P17, CPU (Refl.LB)	1401815
3.	Cable set (complete)	1401874
4.	Measuring head cover	
5.	Measuring head	1402315
6.	Measuring head carrier	1402021
7.	Distance pieces for measuring head	
8.	Reference pads	1402013
9.	Back guide for transport plate	1402005
10.	Axles for measuring head	
11.	Transport table hinge set	1402242
12.	Measuring unit base	
13.	Cover (insert selction)	
14.	Transport plate	1401980
15.	Step motor 3 (measuring head)	1401912
16.	Base plate for motor	
17.	LB 6, P18, CPU (measuring head)	1401823
18.	LB 5, P20, CPU (measuring table)	1401840
19.	LB 1, P21, CPU (transport plate)	1401858
20.	Step motor 1 (measuring table)	1401947
21.	crank	1402099
22.	LB 2, P19, CPU (measuring table)	1401831
23.	Step motor 2 (transport plate)	1401939
24.	Mounting plate for transport motor	
25.	Cam assy for transport plate	1401866
26.	LB 3, P22, CPU (transport plate motor)	1401866
27.	Front guide for transport plate	1401998
28.	gear belt set	1402030
29.	stud screws	
30.	Joint stud with gear wheel	1402064
31.	Worm gear drive set	1402056

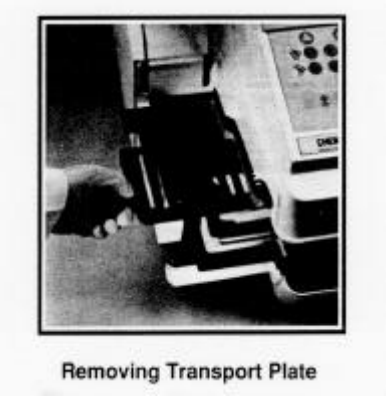
PARTNAME	MATERIAL	DMPRICE	ABC	R	A	ST	K	INSTR
Mains cord (grey)	0501409001					31	1	D4,D3, RM,PQ
FUSE 1 A T (10PCS)	1045725001		B			61	3	RI, RM
Miditron M system	1360990001					31	5	RM
Sediment terminal	1379143001		B		A	31	1	RM
Tray (30 PCS)	1379160001		C			31	1	RM
Calibration strips (50 PCS)	1379194001		A			31	2	RM
Power supply board (+Filter)	3023656001		A		A	30	3	RM
Power filter	3023770001		A		A	30	3	RM
Power distribution board	1401742001		A		A	30	3	RM
CPU-board	1401769001		A	R	A	30	3	RM
CPU-board	1401769984		A	R	A	36	3	RM
Step motor board	1401777001				A	30	3	RM
Keyboard M compl.	1401785001		A		A	30	3	RM
Display	1401793001		A		A	30	3	RM
Light barrier 16	1401807001		A			30	3	RM
Light barrier 17	1401815001		A			30	3	RM
Light barrier 18	1401823001		A			30	3	RM
Light barrier 19	1401831001		A			30	3	RM
Light barrier20	1401840001		A			30	3	RM
Light barrier 21	1401858001		A			30	3	RM
Light barrier 22	1401866001		A			30	3	RM
Cable set	1401874001		A			30	3	RM
Fan compl	1401882001		A		A	30	3	RM
Printer compl.	1401904001		A		A	30	3	RM
Step motor 1	1401912001		A		A	30	3	RM
Step motor 2	1401939001		A		A	30	3	RM
Step motor 3	1401947001		A		A	30	3	RM
Micro switch	1401955001		B			30	3	RM
Fuse 1,8 A, T	1401963001		A			62	3	RM
PC Connector cable	1401971001		C			91	3	RM
Transport plate	1401980001		A	R	A	30	3	RM
Transport plate	1401980984		A	R	A	36	3	RM
Reference plate	1402013001		A			30	3	RM
Measuring head carrier	1402021001		B		A	30	3	RM
Gear belt set	1402030001		A		A	30	3	RM
Guiding axis	1402048001		B			30	3	RM
Worm wheel unit	1402056001		A		A	30	3	RM
Cable LE 3 (PCB-Power-S)	3025365001		C			30	3	RM
Compression spring	1402072001		B			30	3	RM
Crank	1402099001		C			30	3	RM
Measuring unit	1402102001		C	R	A	30	3	RM
Measuring unit	1402102984		C	R	A	36	3	RM
Upper casing	1402129001		C			30	3	RM
Lower casing	1402137001		C			30	3	RM

PARTNAME	MATERIAL	DMPRICE	ABC	R	A	ST	K	INSTR
Side flap	1402145001		C			30	3	RM
Front flap	1402153001		C			30	3	RM
Hinge set front flap	1402161001		C			62	3	RM
Hinge set side flap	1402170001		C			62	3	RM
Instrument feet	1402188001		C			62	3	RM
Frame display	1402196001		C			30	3	RM
Blind plug	1402200001		C			62	3	RM
Paper container	1402218001		C			30	3	RM
Program card II	1402226001		A			30	3	RM
Program card (D/GB)	1402234001		C			62	3	RM
Joint set	1402242001		B			30	3	RM
Program card (A/F)	1402277001		C		A	30	3	RM
Data connected program	1402285001		C			30	3	RM
Justage tool	1402293001		A			30	3	RM
Measuring head	1402315001		A		A	30	3	RM
Program card (E/GB)	1402323001		C			30	3	RM
Program card (I/GB)	1402331001		C			62	3	RM
Program card (F/GB)	1402340001		C			62	3	RM
Real time clock (U23)	1403877001		A			30	3	RM
Microprocessor (U28)	1403885001		B			30	3	RM
EEPROM (U27)	1403893001		A			30	3	RM
OTPROM (U26)	1403907001		A			30	3	RM
Transparent plate (Printer)	1403915001		A			30	3	RM
Service Manual Miditron	1404423001		A			30	3	RM
FUSE 1 AT (10 PCS)	1404687001		B			30	3	D3, RI, RM
Carry case	1406523001		C			62	3	RM
Motion unit	1406736001		A		A	30	3	RM
Profile strip gray II	1406981001		C			30	3	RM
Paper for printer	1415247001		C			31	2	RM
Program card (J/G3)	1565133001		C		A	62	3	RM
Hilt	1703412001		B			30	3	RM
Barcode Reader for Miditron/MJ	1874764001		C	R		30	3	RM
Barcode Reader for Miditron/MJ	1874764984		C			30	3	RM

Maintenance Procedure	Frequency
Cleaning Transport Plate	**Weekly**

To ensure that the instrument operates smoothly, clean the transport plate every week.

1. To do this, press CLEAN and open the side door on the left front of the analyzer. Slide the transport plate out to the left. See figure below.



Removing Transport Plate

2. Wash transport plate under running water or in the laboratory dishwasher. Check for thorough cleaning by ensuring that the black pegs on the underside of the plate are not covered with any urinary deposits.

3. After cleaning, carefully slide the transport plate back into the instrument, ensuring that the plate slides onto the front runner. Ensure a tray is in place, close the side door and press CLEAN to close the analyzer.

Maintenance Procedure	Frequency
Test Strip Disposal	**Approx. every 270 strips**

Each strip is collected in the transport tray disposal area after it is measured. This disposal area can hold approximately 270 strips. When it reaches this capacity, the instrument will display a message requesting that it be emptied.

1. To do this, press CLEAN and the front door will lower. The tray can now be removed and discarded along with the strips. Dispose of tray and strips in accordance with your laboratory's biohazarous waste disposal guidelines.

2. Place a new tray in the analyzer. Tap it slightly to ensure that it is securely in place. Extra trays are supplied in the accessories kit. Trays may also be ordered separately (Cat. no. 418015).

3. Press CLEAN to close the transport mechanism.

Maintenance Procedure	Frequency
Replacing Printer Paper:	**AS NEEDED**

The analyzer will give error code 304 if the printer runs out of paper or if the analyzer is powered ON without paper already in place. The paper in the accessory kit is thermal paper with a unique black square on the top corner. The black square is necessary for the analyzer to detect the presence of the paper and to form feed correctly. Replacement paper (Cat. no. 418009) is available from Boehringer Mannheim Corporation.

1. Insert the printer paper into the take-up slot located on the back of the analyzer. The paper must be inserted so that the black square on the paper can be seen on the left edge from above. See figure below.

Inserting Printer Paper

2. Locate the lever to the left of the printer and slide it downward.

3. Hand feed the paper through the take-up slot, and insert it completely through the printer.

4. Slide the lever back up and press the LINE FEED key (hold down for three to four seconds). The paper will move forward until the analyzer detects the next black square.