ASYS Hitech GmbH

SERVICE MANUAL

Expert Plus

Microplate Reader

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Chapter 1

Instrument Description

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1.1 Introduction

The 'Expert Plus' is a microprocessor controlled 8-channel microplate reader designed to measure the optical density of liquids in the wells of 96-well microplates. It combines a large, graphics display with easy to use on-board software, making it ideal for use in any laboratory performing ELISA and other colorimetric microplate assays. It has both exciting styling and design that place it at the forefront of its class. It can perform single and dual end point measurements at any two wavelengths between 400 and 800nm (340 and 800 nm for Expert Plus UV). Quantitative, qualitative and Kinetics assays can be easily defined and stored in the non-volatile memory. The method definitions can be also performed by means of the delivered PC-based simulation program. Up to 100 sets of measured data can be stored and recalled for later evaluation.

1.2 Features:

Digital light control system

Extra long-time stability

Self-check and self-calibration before each measurement

Robotics friendly design

Low profile self-centering plate carrier and front loading provides easy automation.

Positive filter detection

Never false results because of wrong inserted filters

Light-tight reading chamber

Avoids influence of extraneous light

Stand alone unit with large display and ergonomic keypad

A complete measurement and data analysis system, with no need for PC control

Easy to use programming software

User assays are readily defined, and can be saved for future use

Extensive range of built–in printer drivers

Compatibility with many printers

Small footprint

Saves valuable lab bench space

1.3 Specifications

Parameter	Specification of Expert Plus
Measurement range:	0--4.000 O.D
Wavelength range:	340 to 800 nm (Expert Plus UV) 400 to 800 nm (Expert Plus)
Accuracy:	+/- 1% and +/- 0.005 O.D. at 2.5 OD.
Precision:	+/- 0.5% and +/-0.005 OD. at 2.5 OD
Reading speed:	5 seconds single wavelength
Interference filters:	340, 405, 492, and 620 nm (Expert Plus UV) 405, 450, 492 and 620 nm (Expert Plus) up to 6 filters possible
Light source:	Halogen lamp,50W
Measurement system:	8-channel optical system with self-calibration and self-check
Display:	Graphic LCD, 240 x 128 dots
Keyboard:	24-keys
Printer interface:	Parallel
Computer interface:	RS232-C
Power:	90 to 250V AC, 50/60 Hz, 80 VA
Dimensions:	28 x 43 x 24 cm (WxDxH)
Operating Temperature	+10 to + 35° C
Operating Humidity	0 to 80 % (Non condensing)
Environmental conditions	Humidity 5 to 95%, non condensing (storage only) Maximum altitude 2000m

Chapter 2

Installation

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2.1 Introduction

This chapter contains the necessary information for installing the instrument and the software.

The installation procedures involve unpacking, power requirements, environmental requirements, interfacing and software installation.

2.2 Unpacking and Inspection

The instrument is shipped in one carton which includes:

Instrument,
Power cord,
Computer connection cable,
Software (depending on your order)
Instruction manual

2.2.1 Unpacking Procedure

1. Visually inspect the container for damage before opening it.

   Report any damage immediately to the delivering carrier.

2. Place the carton in an upright position and open it.
3. Lift the instrument out of the carton and place it on a flat surface, free from dust, vibration and away from direct sunlight.
4. Open the plate carrier lid at the front of the instrument and visually inspect the instrument for loose, bent or broken parts.

   Report any damage immediately.

5. Compare the instrument's serial number, attached on the rear panel of the instrument, against the serial number of the instrument, on the delivery (shipping) note.
6. Check the instrument accessories against the delivery (shipping) note.
7. Please save all packing materials, as they maybe required for later transportation.

2.3 Power Requirements

The instrument has an autosensing power supply which operates in the voltage range from 90V to 260 V AC. Check the voltage specifications on the rear panel of the Instrument.

WARNING:
For safe operation of the equipment it is mandatory that it is connected to a wall socket equipped with a ground (earth) connector.

For instructions how to change fuses please refer to chapter 7 of this manual.

2.4 Environmental Requirements

The instrument should be placed on an even surface that is free from dust, solvents and acidic vapors. Vibration and direct sunlight must be avoided, to ensure correct results.

Before the instrument is installed and switched on, it should be left to stand for at least 2 hours, so there is no possibility of condensation causing a malfunction

2.5 Warnings and precautions

If inflammable, toxic or biologically hazardous substances are used when operating the equipment, please observe the instructions and precautions enclosed with such substance.

Never spill fluids in or on the equipment.

Wash your hands thoroughly after handling test fluids.

If equipment has been in contact with hazardous substances, it must be disinfected prior to shipment in accordance with the effective provisions.

Voltages dangerous to human life are present in this device. Do not remove any cover.

Ensure that only fuses with the rated current and of the specified type are used for replacement.

The instrument should be serviced by authorized service personnel only.

Do not expose the instrument to environmental condition outside the one described in the specifications. The system performance may be adversely affected if the instrument is operated outside the temperature range 10–35°C.

2.6 Safety symbols

The following safety symbols may be found in several locations on the instrument. Only persons who fully understand the safety precautions and recognize shock hazards should operate this instrument.

Alternating current

Protective ground terminal

ON

OFF

Caution (see enclosed documents)

Caution, risk of electric shock

2.7 Instrument Installation Procedure

The following procedures detail the necessary steps to be followed when installing the Instrument. When the requirements above have been met, the instrument is installed using the following procedure:

1. Place the instrument into the required position

   Ensure, that the distance between the back panel of the instrument and the wall is at least 10 cm.

2. Remove any packing and transport lock material from the instrument.
3. Plug the printer connection cable with the 25-pin connector into the respective printer port (parallel port) on the reader. Connect the other side with the 36-pin connector to the printer.
4. Ensure the instrument's mains power switch in the back panel of the instrument is in the OFF position.
5. Insert the power cable into the mains power socket in the back panel of the instrument.
6. When a connection to a PC is desired, connect the instrument to the PC by using the supplied RS 232 cable. The interfacing cable is connected into the 9-pin serial interface socket in the back panel of the instrument. Plug the other side of the interface cable into a free serial interface socket of the computer. If the connector of the computer is a 25-pin type, use a 9 to 25-pin adapter.
7. Turn the instrument on.
8. **After the instrument has finished the initialization please perform a Calibration as described in chapter 4.3.2.**

Chapter 3

Theory of Operation

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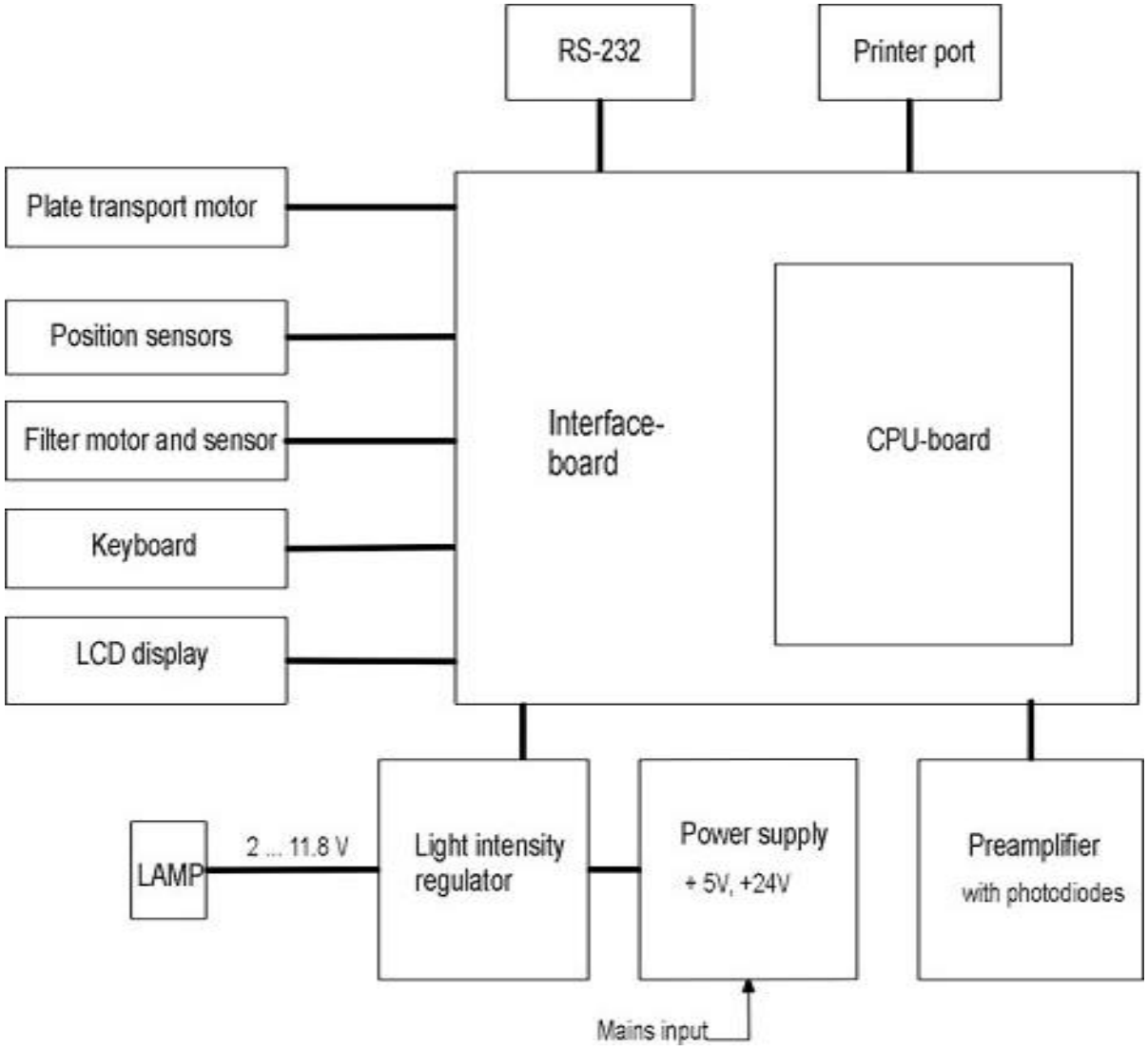
3.1 Introduction

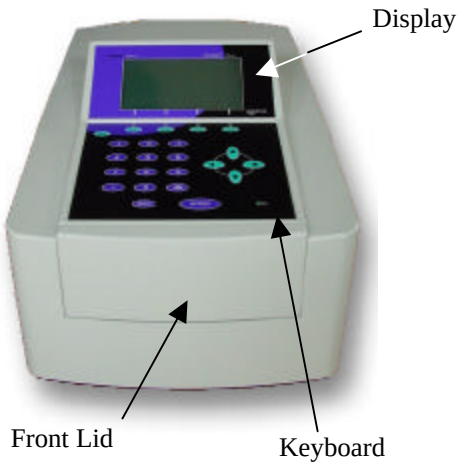
This chapter gives the description of the main components, and describes the functions of the instrument – components.

3.2 Main components

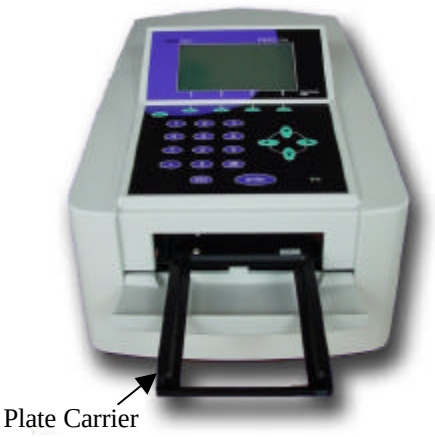
The main components of the instrument are the CPU board, the Analog-Digital converter board with the photodiodes, the plate transport mechanism, the light source, the filterwheel and the power supply unit. The following bloc diagram shows the interconnections of all main components:



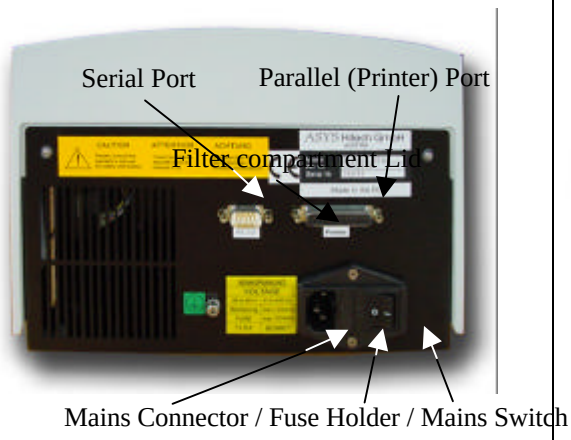
3.3 Outer Appearance



Front View, Plate Carrier in



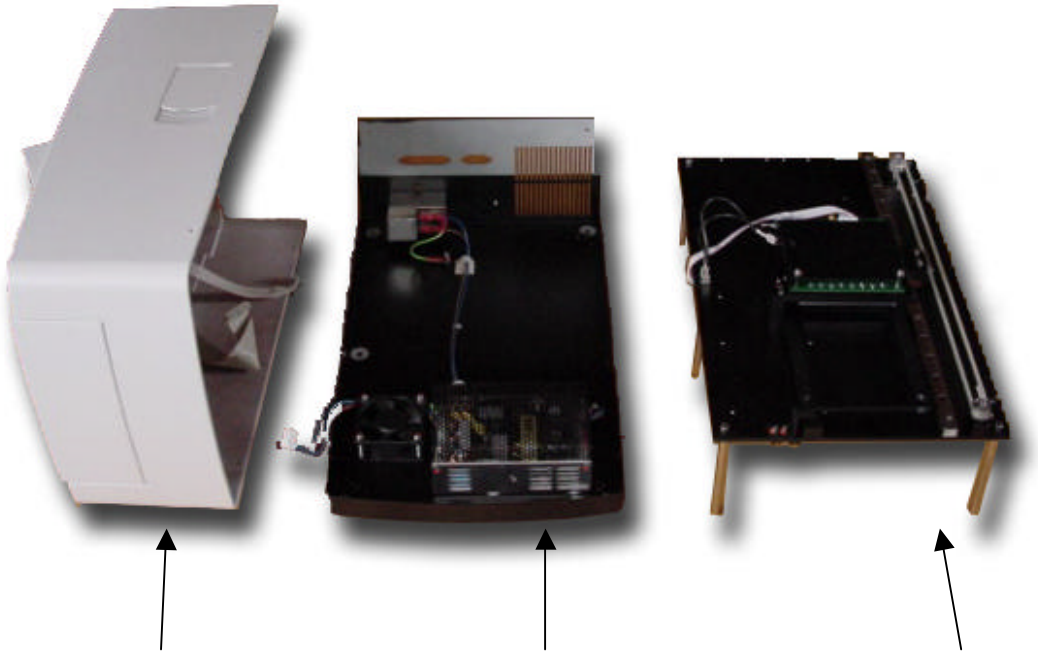
Front View, Plate Carrier out



Rear View

Side View, right side

3.4 Inner View



Instrument Cover **Bottom Plate** **Base plate**

3.4.1 Instrument Cover

The Instrument Cover holds the keyboard and the display and contains the front lid (for light protection of optical system during plate reading) and the filter compartment lid (for easy access to the filter wheel).

3.4.2 Bottom Plate

The Bottom Plate holds the Mains connector with Power switch and Mains fuse holder, the Power supply unit and the cooling fan.

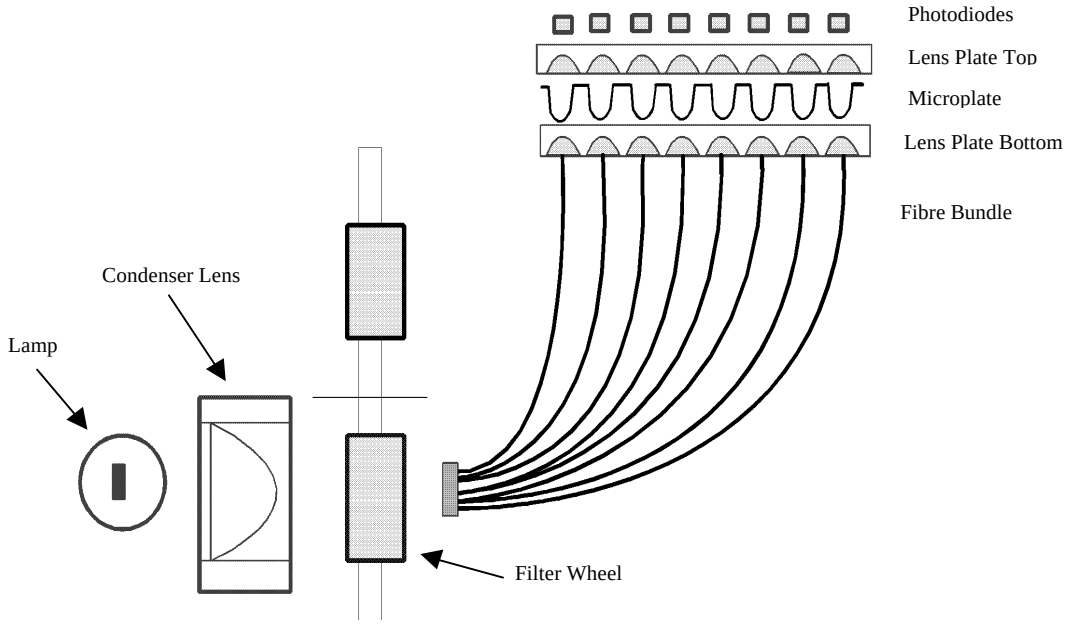
3.4.3 Base plate

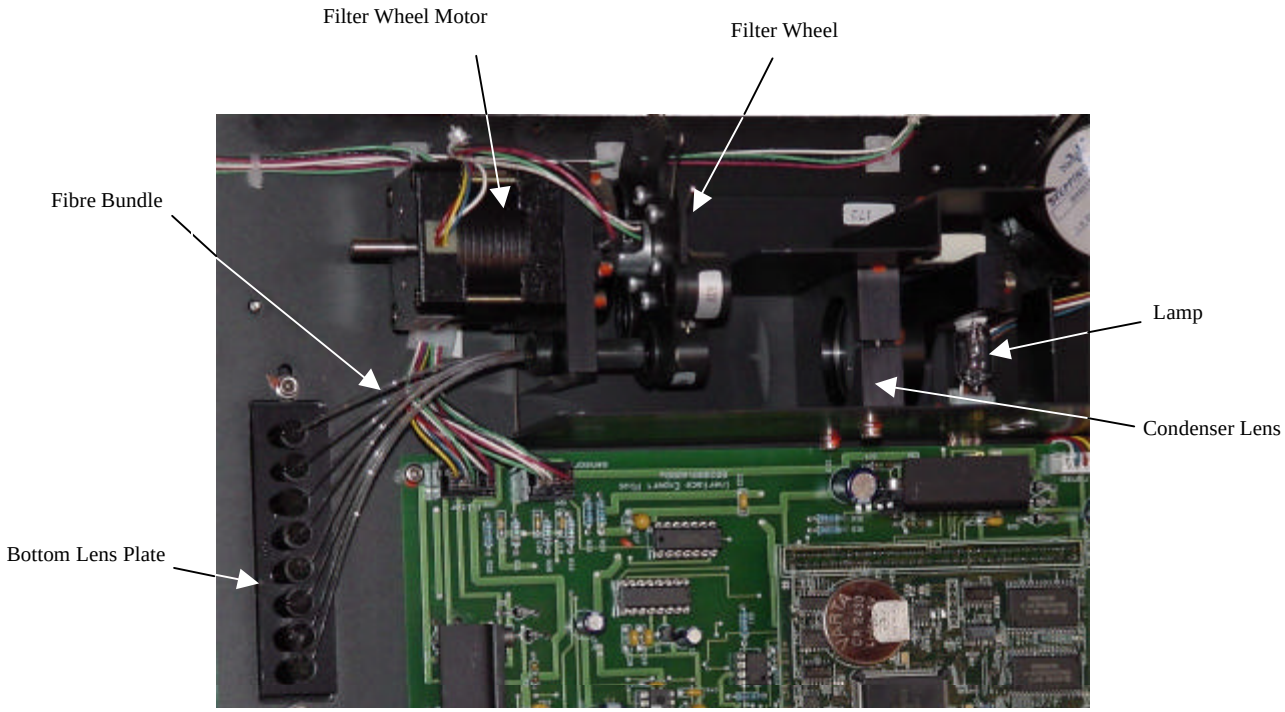
The Base plate holds the complete Optical system, the complete Plate transport and most of the electronic boards.

3.5 Functional Description

3.5.1 Optical system

The optical system consists of the lamp. the condenser lens, the interference filters on the six position filter wheel, the fibre bundle, a focusing lens for each of the eight measurement channels and eight silicon photodetectors with a focusing lens in front of each detector.





Optical System, Bottom view

3.5.1.1 Digital Light Control

The CPU of the Expert Plus reader can control the lamp intensity by means of a 16-bit Digital-Analog converter in combination with the lamp power-supply. At any time the microcontroller "knows" the status of the light control, so that measurement errors caused by undetected light control problems are prevented.

This digital light control system prevents any drift out of the optimum operating range, known to current analogue light control systems. The digital light control makes it possible to detect a lamp failure before the lamp has reached the end of its lifetime.

Another important feature is the active filter detection. If light intensity for a wavelength is different to the value stored in the memory from the prior calibration run (see next point), an error message will be displayed. Any wrong inserted or defective filter will cause therefore an error message.

3.5.1.2 Calibration run (see also chapter 4.3.2 “Filter Calibration”)

The calibration run is initiated any time a filter wavelength is to be changed or by specific request of the user. During the calibration run the lamp intensity for each wavelength is adjusted to a value that guaranties optimum measurement conditions and highest resolution.

These values are stored in the instrument memory. Before each measurement, the actually required light intensity is compared with the stored value, and in this way the system ensures that filters are correctly positioned and are in good condition.

3.5.1.3 Measurement

After the initial calibration run, the required light intensity for each wavelength is known by the system, this means that for any subsequent measurements the light intensity is set to the stored value and only a check as described below is performed.

The plate carrier moves partially inside the reader to avoid influence of external light. The measured light intensity for each channel is compared with the one obtained during the calibration. When the light intensity is within a tight tolerance range the intensity is monitored for approximately 2 seconds and the measurement starts. In case the difference is higher than the set limit but below the warning level the light intensity is readjusted, so that optimum conditions are achieved.

When the difference of the light intensity is too high, an error message is displayed and the measurement is terminated. Also when one channel is below a set limit, a respective error message is shown.

In case of no errors the output for each of the eight channels, known as the 100% value, is stored and the plate transport starts moving.

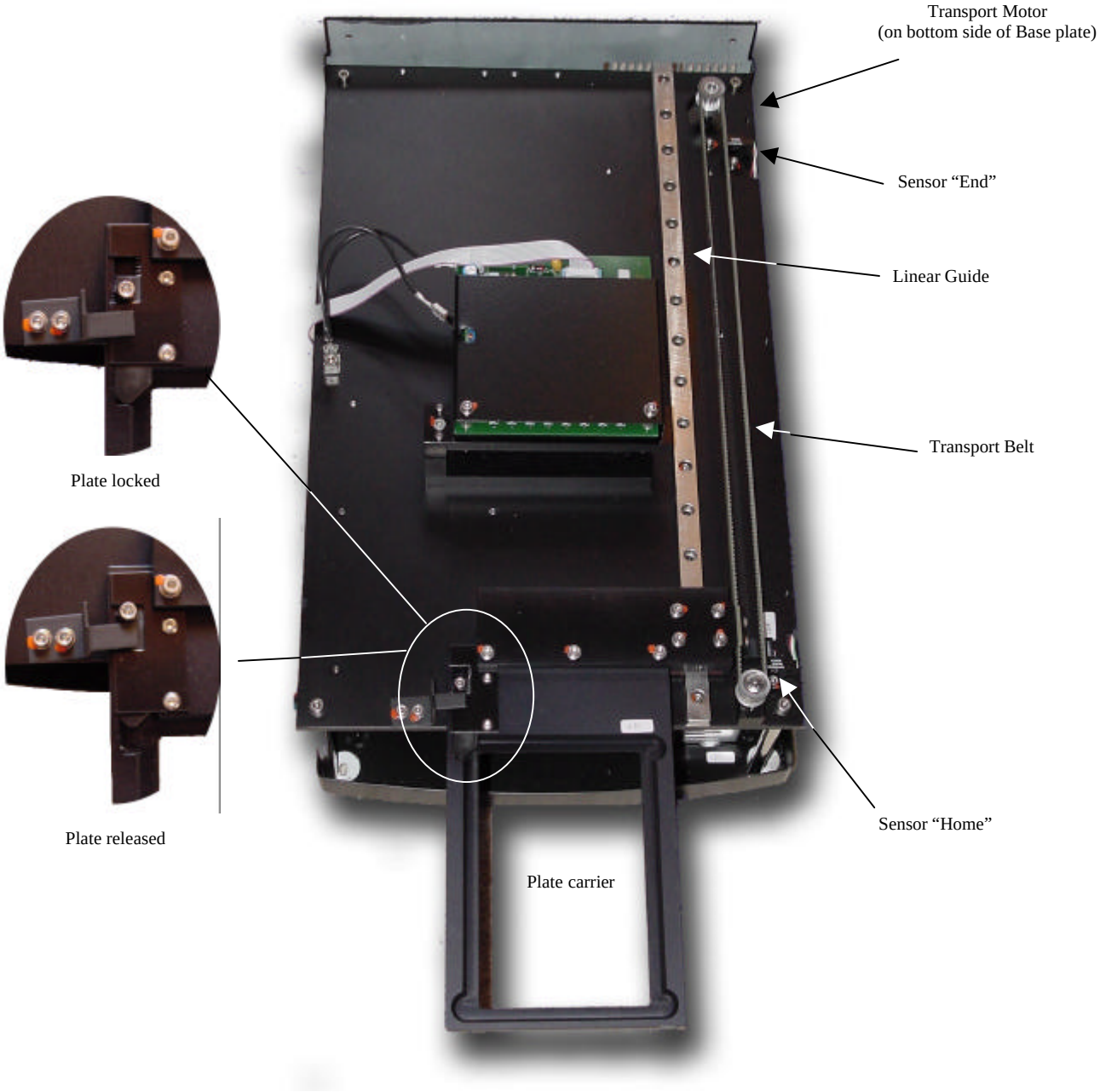
At a position where the plate carrier blocks the light path, the so-called Zero measurement is made. Then several measurements are taken in the center of each well and the average of the measurements for each well are calculated. After the measurement is finished, the absorbance is calculated under consideration of the 100% values and the Zero-measurement. The results are then transmitted to the CPU for further calculations.

3.5.2 Plate Transport System

The plate transport system consists of the plate carrier, a linear guide and one stepper motor driving the belt.

The Plate Carrier itself features an autocentering function, so that any plate type can be inserted easily and is being brought into correct position as soon as the plate carrier moves the plate inside the instrument for reading.

The total movement – range of the plate carrier is limited and controlled by two light barriers at the front and the end of the movement range.



3.5.3 Display / Keyboard unit

The display and the keyboard of the instrument represent the user interface, respectively the components for the operator to communicate with the instrument.

The **Display** is a graphical LCD display.

The **Keyboard** gives access to all functions and menus of the instrument; it comprises:

- 4 Function keys (F1 – F4)
- Service menu entry key ( )
- Numerical keys 0 – 9, comma
- Back / Delete key ( )
- Enter Key
- Esc Key
- 4 Cursor Keys 
- Power On LED

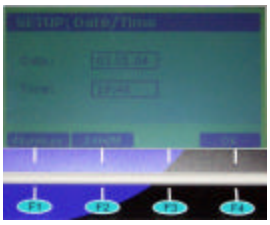
The **4 Function keys** are used for selecting menu points, that are directly diplayed above the respective key. The menu points vary, depending on the menu or submenu selected.

Example: Setting time and Date

F1 will scroll through the available date formats

F2 will scroll through the available time formats

F4 will save the set time and exit the menu



The **Service menu entry** key is required to enter the Instrument Service Menu (see chapter 5)

The **Numerical keys** and the **Comma key**, as well as the **Back/Delete key** are used for entry of numerical values, whenever required during operation the instrument

The **Enter key** is used to confirm entered values, make selections etc.

The **Esc key** is used to exit from menus and submenus. Pressing the esc key, will leave the actual menu and bring to instrument back to the previous level menu.

The **Cursor keys** are used to select menus, menu points and entry fields.

The **Power On LED** verifies, if the instrument is switched on. This may be useful in case the display remains dark due to any malfunction, even after the instrument has been powered on.

Chapter 4

Instrument Setup Menu

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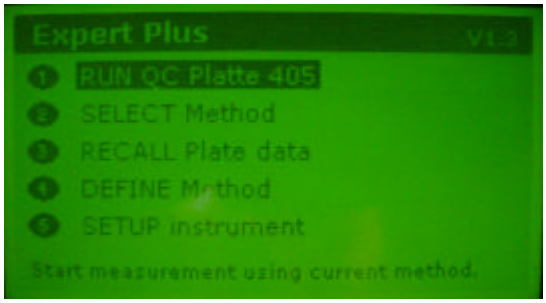
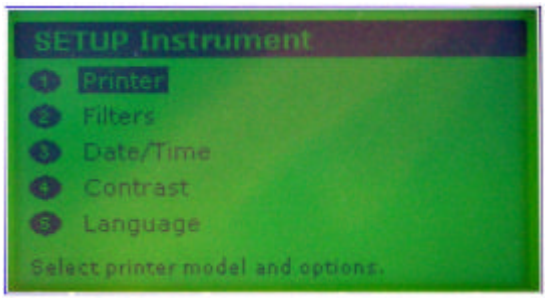
4.1 Introduction

This chapter gives the description of the Instrument Setup Software Menu. Enter the Instrument Setup Menu

When the instrument is being switched on, or during standby, the display shows following screen:



To enter the Instrument Setup Menu, press key " **5** ". The instrument now enters the Setup menu and displays the following screen:



4.3 Functions of the Instrument Setup Menu

The possible settings in the Instrument Setup Menu are:

- **Printer:** Printer Manufacturer and Model
- **Filters:** Calibrate Filters
- **Date / Time:** Set Date and Time Format
- **Contrast:** Set the Display Contrast
- **Language:** Select the preferred language for display messages

The next pages explain the settings in detail.

4.3.1 Printer type / model selection

The instrument has a wide range of the most common printer drivers pre-programmed. This setting is used to define which printer is connected to the instrument, so that the correct printer driver is being used.

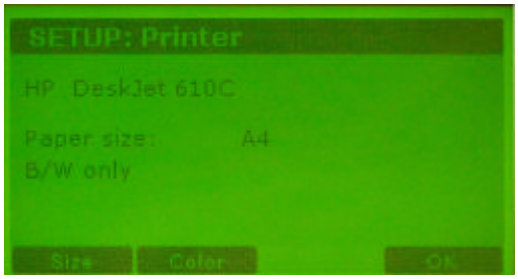
Enter the Instrument Setup Menu as described in chapter 4.2. When the Instrument Setup Menu Start screen is displayed, select the menu point "**Printer**" by pressing the numerical key " **1** " and the display will show the following screen:

Using the keys " **Cursor up** " and " **Cursor Down** " select the manufacturer of the printer you are using with the instrument. Confirm your selection with the " **Enter** " key.

As soon as the selection has been confirmed, you are requested to select the model from the list of the previously selected manufacturer:

Using the keys " **Cursor up** " and " **Cursor Down** " select the manufacturer of the printer you are using with the instrument. Confirm your selection with the " **Enter** " key.

As soon as the selection has been confirmed, you are requested to enter the paper format used, and if the printer should print in color or in B/W:



By pressing the key " **F1** " you can toggle between the available paper sizes

By pressing the key " **F2** " you can toggle between Color and B/W (if available for this printer)

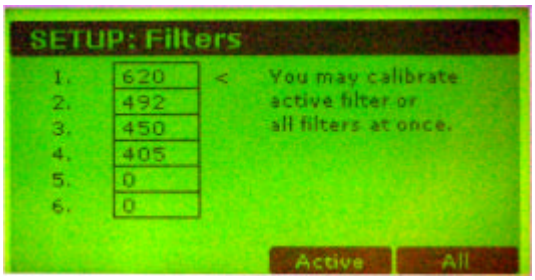
By pressing the key " **F4** " the selections are being stored into the instruments memory, and the instrument will return to the Instrument Setup Menu start screen.

4.3.2 Setup Filters

This menu point is used for entering / changing filter wavelengths when new / other filters are being inserted, and for calibrating filters.

Calibrating filters is required after first installation of the instrument. Also, when replacing one or more of the optical filters, the optical system must be calibrated to these (see more detailed explanation in chapter 3.5.1.2).

Enter the Instrument Setup Menu as described in chapter 4.2. When the Instrument Setup Menu Start screen is displayed, select the menu point "**Filters**" by pressing the numerical key " **2** " and the display will show the following screen:



4.3.2.1 Set / Change Filter Wavelength:

By using the keys " **Cursor up** " and " **Cursor Down** " move the selector (**<**) to the required filterposition. The wavelength setting for the selected filter position will start to blink. Enter the new wavelength by using the numerical keys.

When the wavelength has been entered, press the key " **F3** " for calibration of the optical system to the new inserted filter. Only after this calibration, the new wavelength will be accepted and stored into the instruments memory.

4.3.2.2 Calibrate Filters:

Either single filter positions, or all filters can be calibrated. It is always recommended to calibrate all filters, however. To calibrate all filters, press " **F4** "; to calibrate one specific filter, use the keys " **Cursor up** " and " **Cursor Down** " to select the required filter and then start the calibration by pressing " **F3** "

4.3.3 Date / Time Setting

Enter the Instrument Setup Menu as described in chapter 4.2. When the Instrument Setup Menu Start screen is displayed, select the menu point "**Date/Time**" by pressing the numerical key " **3** " and the display will show the following screen:

Press " **F1** " to select between the available date formats (**dd.mm.yy** or **mm-dd-yy** or **yy/mm/dd**)

Press " **F2** " to select between the available time formats (**24H/M** or **M/24H**)

Enter the correct date using the numerical keys.

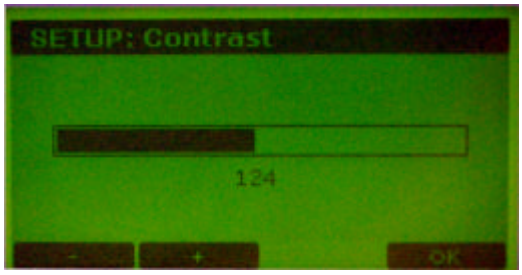
Use the keys " **Cursor up** " and " **Cursor Down** " to switch between Date and Time setting

Enter the correct time using the numerical keys.

Press " **F4** " to confirm settings and store them into the instrument memory.

4.3.4 Display Contrast Setting

Enter the Instrument Setup Menu as described in chapter 4.2. When the Instrument Setup Menu Start screen is displayed, select the menu point "**Contrast**" by pressing the numerical key " **4** " and the display will show the following screen:



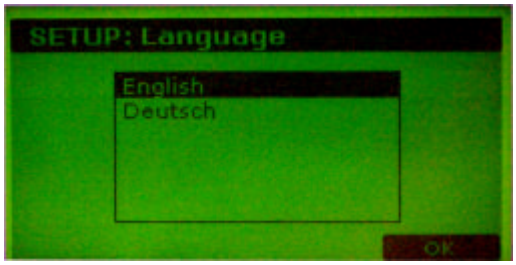
Press " **F1** " to increase display contrast

Press " **F2** "to decrease display contrast

Press " **F4** " to confirm settings and store them into the instrument memory.

4.3.5 Language Setting

Enter the Instrument Setup Menu as described in chapter 4.2. When the Instrument Setup Menu Start screen is displayed, select the menu point "**Language**" by pressing the numerical key " **5** " and the display will show the following screen:



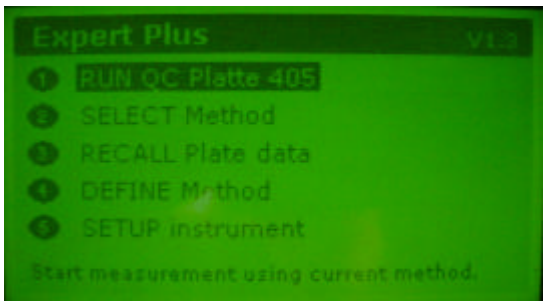
Use the keys " **Cursor up** " and " **Cursor Down** " to switch between "**English**" and "**Deutsch**"

Press " **F4** " to confirm settings and store them into the instrument memory.

4.3.6 Exit the Instrument Setup Menu

At the end of each setting, when performed correctly, the instrument will always return to the start screen of the instrument setting menu. Pressing the key " **esc** " at that point, will exit the instrument setup menu.

However, pressing the key " **esc** " at any menu / submenu will always bring the instrument to the next higher level of the software menu structure. At the end the instrument will display the standby screen:



Chapter 5

Service / Diagnosis Menu

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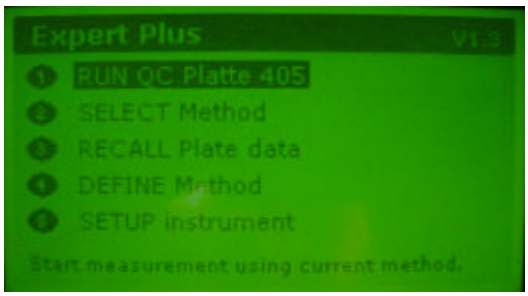
5.1 Introduction

This instrument is fitted with a highly sophisticated service and diagnosis software for verification of instrument functions, trouble shooting and special settings.

This chapter will explain the functions and the handling of this menu.

5.2 Enter the Instrument Service / Diagnosis Menu

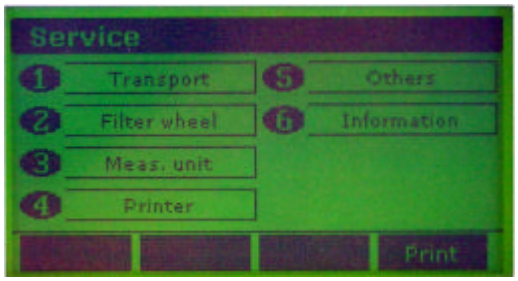
When the instrument is being switched on, or during standby, the display shows following screen:



This menu allows settings that, if performed by un-authorised personnel or not performed properly, may cause major malfunctions of the instrument !

To enter the Service / Diagnosis Menu, press the key “  ”. The instrument will now request you to enter the password. Use the numerical keys to enter the **password: 5020** and confirm with “ **enter** ”

The instrument now enters the Service / Diagnostic menu and displays the following screen:



5.3 Functions of the Service / Diagnosis Menu

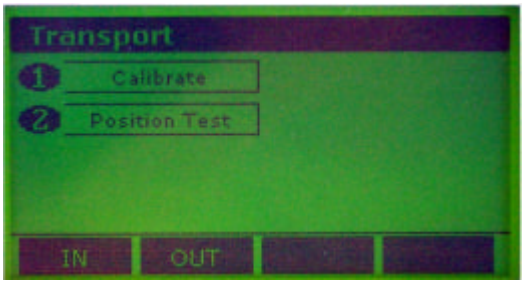
The possible settings / checks in the Service / Diagnosis Menu are:

- **Transport:** Calibration and Position test
- **Filter Wheel:** Calibration, Position test and Zero setting
- **Meas. Unit:** Diode Tests, Filter Calibration, Simulated reading (Duration test), Recall of measured plates, Set Plate definitions
- **Printer:** IO Port setting, Printer type setting, HW setting, Printer Test
- **Others:** Check Sensors, DAC – output, Test Keyboard
- **Information:** Information on versions of onboard firmware / software

5.3.1 Service - Submenu "Transport"

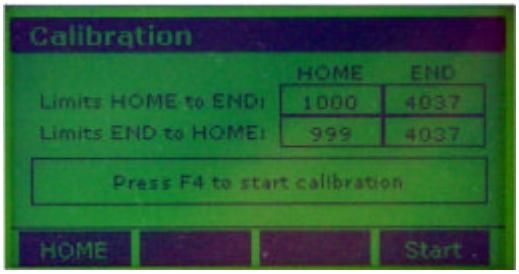
This submenu allows to calibrate the plate transport and to check specific positions, and to move the plate transport "manually" step by step.

Enter the Service / Diagnosis Menu as described in chapter 5.2. When the Service / Diagnosis Menu Start screen is displayed, select the menu point "**Transport**" by pressing the numerical key "**1**" and the display will show the following screen:



5.3.1.1 Calibrate Transport

To enter the **Calibrate menu**, press " **1** " when the screen as above is displayed. The display will now show the following screen:



Pressing " **F1** " will move the transport to Home position (= out), pressing " **F2** " will move the transport to End position (= in).

Pressing " **F4** " will start the calibration run. During this calibration run, the plate transport will be moved in and out to it's home and end positions for 5 times. During these movements, the distance between transport home sensor and transport end sensor will be automatically calibrated. This procedure is required to be performed when parts of the transport system (e.g.: sensors, belt etc.) have been replaced.

5.3.1.2 Position Test

To enter the **Position Test Menu**, press " **2** " when the screen as in 5.3.1 is displayed. The display will now show the following screen:

This menu allows to define specific positions to move the plate carrier to, to manually step the transport in and out.

Use the keys "**Cursor up**" and "**Cursor down**" to select the entry fields for "Move to". Enter values (between 0 and 3037) using the numerical keys. After the requested position has been entered, you must confirm the value by pressing "**Cursor up**" and then "**Cursor down**" and then "**Enter**"

Use the keys "**Cursor left**" and "**Cursor right**" to manually step the transport motor in and out.

Use the keys "**F1**" and "**F2**" to move the transport to End (=in) and Home (=out) positions.

5.3.2 Service - Submenu "Filter Wheel"

This submenu allows to calibrate the Filter wheel, to check specific positions and Define the Zero Position of the filter wheel.

Enter the Service / Diagnosis Menu as described in chapter 5.2. When the Service / Diagnosis Menu Start screen is displayed, select the menu point "**Filter Wheel**" by pressing the numerical key "**2**" and the display will show the following screen:

***ATTENTION:* The Submenu "Define Zero" should never be opened, except after replacing the filter wheel sensor (see chapter 7.8) !**

When the Zero value of the filter wheel is being changed to an invalid value, the filter wheel will not position properly, and readings will give wrong results!

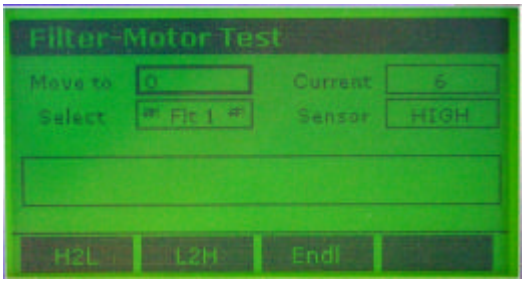
5.3.2.1 Calibrate Filter Wheel

To enter the **Calibrate menu**, press " **1** " when the screen as above is displayed. The display will now show the following screen:

Pressing "**F4**" will calibrate the Filter wheel home position sensor.

5.3.2.2 Filter Wheel Position Test

To enter the **Position Test** menu, press " **2** " when the screen as in 5.3.2 is displayed. The display will now show the following screen:



This menu allows to define specific positions to move the Filter wheel to, and to check the Filter wheel sensor.

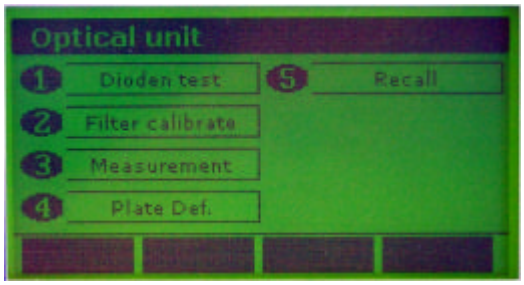
Use the keys "**Cursor up**" and "**Cursor down**" to select the entry fields "Move to" or "Select Filter Position" . Enter values (between 0 and 198) using the numerical keys. After the requested position has been entered, you must confirm the value by pressing "**Cursor up**" and then "**Cursor down**" and then "**Enter**".

Use the keys "**F1**" to perform a **Sensor High to Low cycle**, and "**F2**" to perform a **Sensor Low to High** cycle. Use "**F3**" to start an endless rotation of the filter wheel.

5.3.3 Service - Submenu “Meas Unit”

This submenu allows all kinds of checks and verifications of the optical system, A/D board and signal amplification.

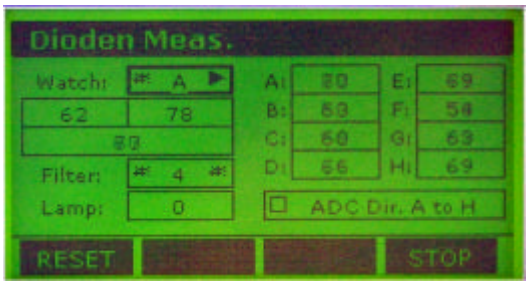
Enter the Service / Diagnosis Menu as described in chapter 5.2. When the Service / Diagnosis Menu Start screen is displayed, select the menu point “**Meas Unit**” by pressing the numerical key “**3**“ and the display will show the following screen:



5.3.3.1 Dioden Test

This submenu can be considered as the main verification tool of the optical system of the instrument.

To enter the **Dioden Test** menu, press “ **1** “ when the screen as in 5.3.3 is displayed. The display will now show the following screen:



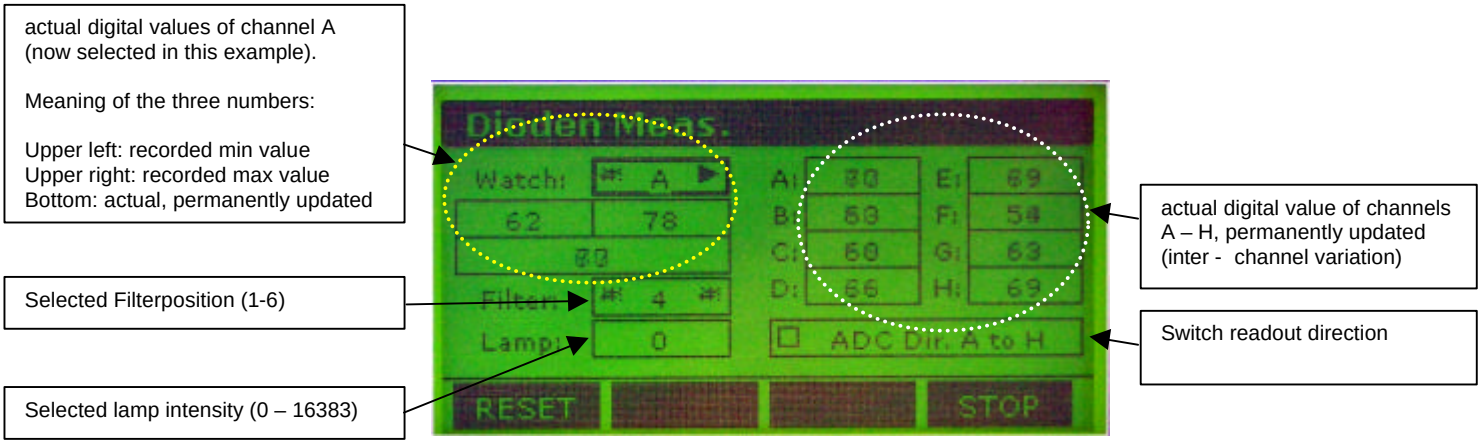
This menu allows to check each of the eight optical channels, with each of the available wavelengths, at selectable lamp intensity.

This menu is also used for calibration / adjustments in case parts of the optical system have been changed (e.g.: Fiber bundle, condenser lens etc.).

This screen allows to find out if:

- the lamp and mains lens are ok
- the optical filters are ok
- the lenses of the upper or lower lens blocks are clean
- the optical fibres are ok
- the optical channels are aligned properly

See next page for more detailed description of this menu.



Use the keys **"Cursor up"** and **"Cursor down"** to select the entry fields "Watch", "Filter", "Lamp" and "ADC Dir. A to H".

Use the keys **"Cursor left"** and **"Cursor right"** to select channels and filters.

Use the numerical keys to enter the lamp intensity (0 – 16383).

Use **"F1"** to reset the recorded max and min values of the selected channel.

Use **"F4"** to freeze all values

Expected "good" - values:

1.) Set Lamp intensity to 15000, the digital values of all channels must be in overflow (65535), with all filters.

2.) Select Filter 1, increase Lamp intensity step by step until the highest digital value is appr. 60000. Now, the lowest digital value must not be lower than 50000. Check with all filters (you need to re-adjust lamp intensity for each filter separately)

Press "**esc**" to escape from this menu and to return to the **Service Start Screen**.

5.3.3.2 Filter Calibrate

This submenu has the same function as the menu "Setup Filters" in instrument setup menu (chapter 4.3.2).

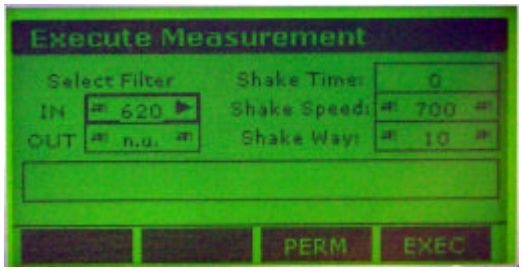
For setting and calibrating filters, refer to chapter 4.3.2.

5.3.3.3 Measurement

This submenu is used for testing of the complete instrument by simulating a definable plate reading in either single or endless mode. There will be no recording / reporting of measurement results.

This menu is used for duration testing during the manufacturing process of the instrument.

To enter this submenu, press "**3**" when the screen as in 5.3.3 is being displayed. The display will then show the following screen:



Use the keys **"Cursor up"** and **"Cursor down"** to select the entry fields.

Use the keys **"Cursor left"** and **"Cursor right"** to select values.

Use **"F3"** to start a permanent (endless) run.

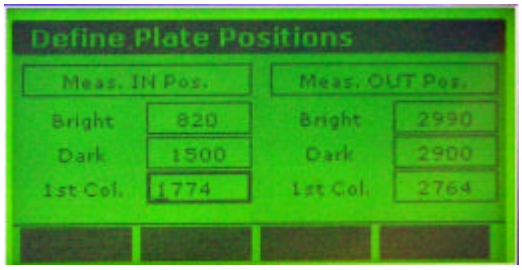
Use **"F4"** to start a single run.

5.3.3.4 Define Plate Positions

This submenu is used for setting reference values for the plate transport system.

Do not change any of these values without having the manufacturers QC plate available !

To enter this submenu, press "**4**" when the screen as in 5.3.3 is being displayed. The display will then show the following screen:



Use the keys **"Cursor up"** and **"Cursor down"** to select the entry fields. Use the keys **"Cursor left"** and **"Cursor right"** to select values.

The values in "Bright" and "Dark" are factory set and should not be changed.

The values in "1st Col" (Meas in and Meas out) are determined by using the manufacturers QC Plate (more information in the manual of the QC plate)

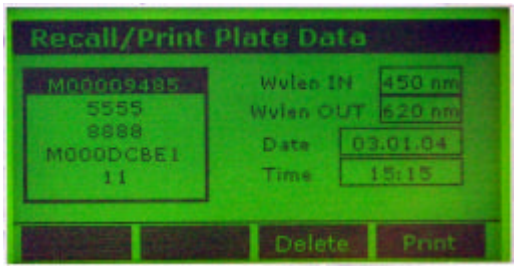
Use the numerical keys to enter the required numbers.

Do not change any of these values without having the manufacturers QC plate available !

5.3.3.5 Recall

This submenu is used to recall and / or delete measured plates from the instruments memory. These functions are also available in “Recall Plate Data” from the instrument main menu (see user manual).

To enter this submenu, press “**5**” when the screen as in 5.3.3 is being displayed. The display will then show the following screen:



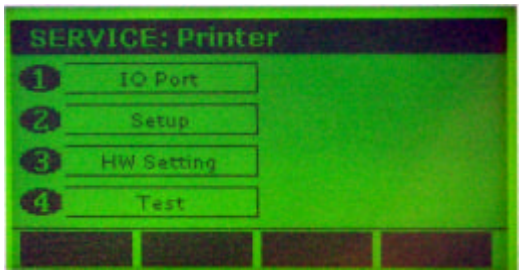
Use the keys **“Cursor up”** and **“Cursor down”** to select the plate data of interest.

Press “**F3**” to delete, or “**F4**” to print the selected plate data.

5.3.4 Service - Submenu “Printer”

This submenu allows all kinds of checks and settings for the printer that is connected to the instrument.

Enter the Service / Diagnosis Menu as described in chapter 5.2. When the Service / Diagnosis Menu Start screen is displayed, select the menu point “**Printer**” by pressing the numerical key “**4**“ and the display will show the following screen:



5.3.4.1 IO Port

This submenu is used to define some of the settings for the communication between instrument and connected printer. These settings should only be changed if there are problems with the printout, and only after prior consultation of the manufacturer.

To enter this submenu, press "**1**" when the screen as in 5.3.4 is being displayed. The display will then show the following screen:

Use the keys **"Cursor up"** and **"Cursor down"** to select the parameter that requires changes.

Use the keys **"Cursor left"** and **"Cursor right"** to activate or de-activate the selection.

Press "**F1**" to initiate a Form Feed, "**F2**" to initiate a carriage return, "**F3**" to make a line feed and "**F4**" to send a print command to the printer. Pressing F4 once, will print "A", pressing F4 three times, will print "ABC" etc.

5.3.4.2 Setup

This submenu has exactly the same function as "Printer" in the instruments setup menu (chapter 4.3.1).

5.3.4.3 HW Setting

This submenu is used to define the printer timeout (= the time the instrument will wait for a connected printer to respond, before giving the error "Printer timeout")

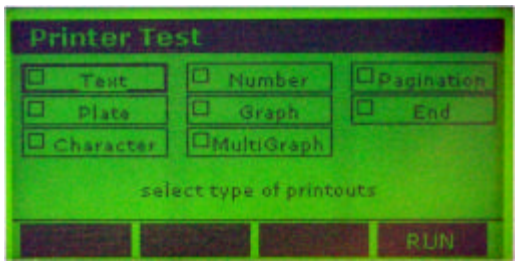
To enter this submenu, press "**3**" when the screen as in 5.3.4is being displayed. The display will then show the following screen:

Use the numerical keys to enter the required printer timeout.

5.3.4.4 Test

This submenu is used to test the communication between instrument and printer, and may be used for testing printer commands. The instrument has pre-defined test sets, which can be sent to the connected printer.

To enter this submenu, press "**4**" when the screen as in 5.3.4is being displayed. The display will then show the following screen:



Use the keys **"Cursor up"** and **"Cursor down"** to select the function to be tested. Single, several or all functions may be selected at once.

Use the keys **"Cursor left"** and **"Cursor right"** to activate or de-activate the selection.

Press "**F4**" to start the test.

5.3.5 Service - Submenu "Others"

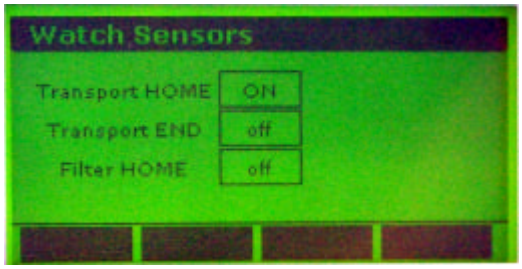
This submenu allows to test / check the function of the inbuilt position sensors, the function of the display and the digital light intensity control, as well as the function of the keyboard.

Enter the Service / Diagnosis Menu as described in chapter 5.2. When the Service / Diagnosis Menu Start screen is displayed, select the menu point "**Others**" by pressing the numerical key "**5**" and the display will show the following screen:

5.3.5.1 Watch Sensors

This submenu is used to test the function of the optical sensors of the instrument.

To enter this submenu, press "**1**" when the screen as in 5.3.5 is being displayed. The display will then show the following screen:



This screen shows the actual status of all three sensors of the instrument. The instrument has three sensors: Transport Home, Transport End and Filter wheel.

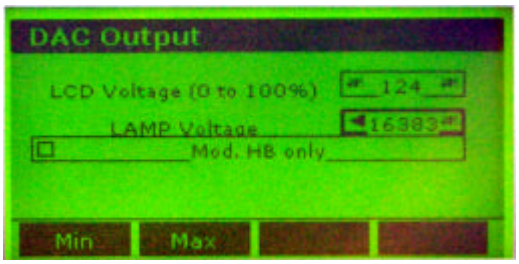
The status is updated permanently, which allows a manual function test of the sensors, when the instrument is opened. ***See chapter 6 "Replacing Parts" on how to open the instrument !***

Sensors can be manually checked by using a small piece of paper and moving it into the sensor area. The change of the status can be watched in this screen.

5.3.5.2 DAC Output

This submenu is used to test the function of the digital-analog-converter for Display and lamp.

To enter this submenu, press "**2**" when the screen as in 5.3.5 is being displayed. The display will then show the following screen:



Use the keys **"Cursor up"** and **"Cursor down"** to select the function to be tested.

Use the keys **"Cursor left"** and **"Cursor right"** to change the actual value stepwise.

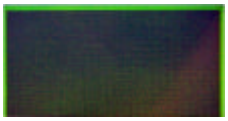
Press "**F1**" to set the selected function to minimum supply.

Press "**F2**" to set the selected function to maximum supply.

ATTENTION:

Setting LCD voltage to either Min or Max will have one of the following effects:

LCD Min



LCD Max

Pressing the key "**esc**" will escape this submenu and get the display contrast back to the preset range (as defined in instruments settings, "Display Contrast", chapter 4.3.4) .

5.3.5.3 Test Keyboard

This submenu is used to test the function of the instrument keyboard.

To enter this submenu, press "**3**" when the screen as in 5.3.5 is being displayed. The display will then show the following screen:

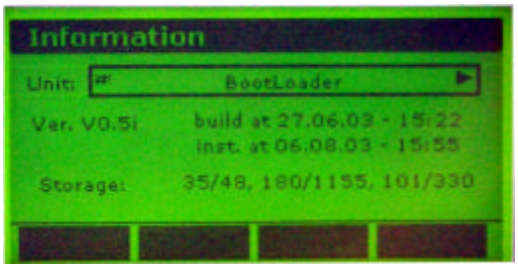
Pressing any key will insert the code of the respective key into the field "Code". As long as the key is being kept pressed, the field "Repeat" will keep increasing. As soon as the pressed key is being released, there will be displayed a "YES" in the field "Release".

Pressing and Holding "esc" has the same function as described above, releasing "esc" will escape this submenu.

5.3.6 Service - Submenu "Information"

This submenu gives information on the versions of the inbuilt firmware and software. This information may be required in case support by the manufacturer is required.

Enter the Service / Diagnosis Menu as described in chapter 5.2. When the Service / Diagnosis Menu Start screen is displayed, select the menu point "**Information"** by pressing the numerical key "**6**" and the display will show the following screen:



Use the keys **"Cursor left"** and **"Cursor right"** to select the firmware / software module of interest.

5.3.7 Exit from Service Menu

To exit from Menus and submenus, press the "**esc**" key. Each time the "**esc**" key is pressed, the instrument will switch to the next upper level in the menu structure.

When the "**esc**" key is being pressed when the Service Menu Start screen is being displayed, the instrument will perform an initialization routine and return to standby.

Chapter 6

Error Handling and Fault Finding

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6.1 Error indication

If an error occurs during measurement, the corresponding error message or number is displayed in the status window.

6.1.1 Error Codes for instrument errors:

Instrument errors are indicated by a numeric and / or textual error message in the status window. In the case of an error during a measurement, try to restart the measurement. If the error continues, see the table below for a possible remedy.

Error name	Error description	Possible cause
General system error	Time-out during initialization of reader	Transport blocked, filterwheel blocked
Transport error	Plate carrier does not reach the respective sensor	Plate carrier jams
Invalid measurement position	Error in the transport position table	
Measurement error high	AD-converter output overflow	Light intensity regulation defective, missing filter
Measurement error low	AD-converter output too low	AD-converter defective, power supply failure, lamp failure, filter defect, filterposition
Lamp drift	Light intensity differs from calibration values	Calibration required, filter defective
Channel low	Output of one measurement channel below the set minimum value	one optical path blocked by spillage, filter defective
Light intensity too high	The light intensity measured during self-check is too high.	Light regulation board defective

NOTE: Perform board level repair only if you have a good knowledge of the circuits and if you have an ESD (electro static discharge) safe working place. In doubt replace boards only.

6.2 Trouble Shooting

6.2.1 General error

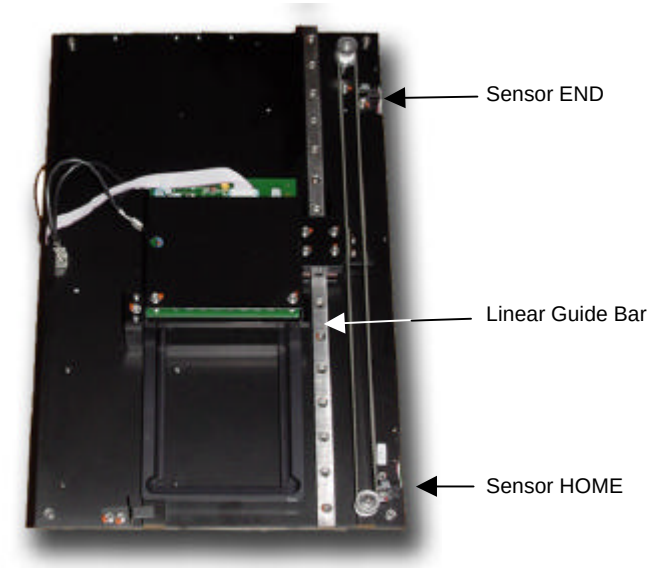
This error can happen during the initialisation of the reader after switch-on only. When one of the initialisation procedures cannot be finished within a certain time, the error message nr. 1 will be shown.

Components to be checked in case of Error 1:

Plate transport, optical sensors, filterwheel, AD-converter.

6.2.2 Transport error

This error appears, in case the plate carrier does not reach the opposite sensor within the number of programmed steps.



Possible causes and remedies:

1. Plate transport jams

   → Clean the linear guide bar and add silicon free grease or similar as lubricant on the linear guide bar.

2. Sensor or sensor circuit defective. Sensor output must change between < 1 Volt and > 4 Volt.

   → Check function of sensor and sensor circuit in Instrument Service Menu (see chapter 5.3.5.1)

3. If required, replace the sensors as described in chapter 7.8

6.2.3 Measurement error high

When the output of the AD-converter is permanent above 64000 counts during calibration or measurement, the 'Measurement error high' is displayed. The 64000 counts are representing an input voltage of more than 10 Volt on pin 2 of IC5.

The output signal of the AD-converter can be checked in the instrument Service Menu (see chapter 5.3.3.1)

Possible causes and remedies:

1. No filter present

   → check that all filters as defined in the Instrument Setup Menu are present, at the correct position on the filter wheel.

2. Interface board defective

   → replace Interface board (see chapter

3. The negative 12V supply is missing or below nominal

6.2.4 Measurement error low

When the output of the AD-converter does not reach 63000 counts during calibration or self-check, the Measurement error low is indicated.

Possible causes and remedies:

1. The filter is defective, its transmittance is too low.

   → Change the filter.

2. The lamp does not produce enough light intensity.

   → Check the lamp voltage, it must be 11,7 +/- 0.2 V when the lamp intensity is set to 15500 counts.

   → If the voltage is OK change the lamp, otherwise check the power supply.

3. The optics are dirty.

   → Check for liquid spillage and dirt on the lenses.

6.2.5 Lamp drift

In case the light intensity for the lowest and/or the highest channel measured before the actual reading is different from the light intensity found during the calibration, the error message Lamp drift is shown.

Possible causes and remedies:

1. The lamp has changed the intensity.

   → Perform a calibration and try some repeated measurements. If this solves the problem, monitor the instrument for the next days. If the error is shown again, replace the lamp.

2. The filter selected for the measurement is different from the filter during the last calibration.

   → Check if the wavelength indicated on the filter corresponds to the wavelength displayed for the relevant position on the filterwheel. The wavelengths can be seen best using the calibration menu of the service program. If a wrong inserted filter is found, put the filter back into the correct position and perform a calibration run.

3. The filter has become defective.

   → Remove the filter. Hold it against a bright light source and check for dark spots or opaque areas. Replace the filter in case of visual impurities.

4. The filterwheel is not in the correct position.

   → Open the lid for the filter compartment and start a measurement. Watch if the light beam is in the centre of the filter. If this is not the case, the position of the filterwheel must be readjusted:

   a. Open the filter compartment at the right side of the instrument

   b. Start the Service menu as described in 5.3.2 and select “Define Zero”

   c. Select Filter 1 and look at the filterwheel. Filter 1 (usually the 620 nm filter) should be exactly in the center of the light beam. When this is not clearly seen, you can check that filter 1 and filter 4 are at the same horizontal level.

   d. In case the position of filter 1 is not correct, you can move the position with the Up / down arrow keys. When the position is correct, press key F4 ‘ SET’ to store the new position. Check the position again by pressing the Enter key, the filterwheel will make one revolution and should be at the same location as before.

5. The lenses have become dirty.

   → Check if you can see dirt or spillage on the lenses. In case of dirt remove the diaphragm on the lower lens bloc carefully by lifting it up with a small screwdriver or similar. Clean the lenses with a lens cleansing agent or alcohol. After cleaning glue the diaphragm back on its original position.

6.2.6 Channel low

In case one of the channels receive not enough light during the self check, the ._error Channel low is indicated. This can happen for one, several and all wavelengths.

To find the channel with low light start a measurement with the service program. After the error message is displayed, press F7 to display the light intensity for all the channels. Now you can see at the bottom line of the diode window which of the channels is below the lower limit of 48000 counts.

Possible causes and remedies:

1. The lenses have become dirty or foreign particles are blocking the light path.

   → Check if you can see dirt, spillage or foreign particles on the lenses respectively on the diaphragm . In case of dirt on the lenses remove the diaphragm carefully by lifting it up with a small screwdriver or similar. Avoid bending of the diaphragm. Clean the lenses with a lens cleansing agent or reagent-grade isopropyl alcohol. After cleaning glue the diaphragm back on its original position.

2. The filterwheel is not in the correct position.

   → Open the lid for the filter compartment and start a measurement. Watch if the light beam is in the centre of the filter. If this is not the case, the position of the filterwheel must be readjusted.

3. The lamp has become loose.

   → Check the tight fit of the lamp in the spring loaded lamp holder. The lamp must be snap-in into the correct position.

4. Especially in case the error happens with one filter only this filter may have become defective.

Chapter 7

Parts Replacement

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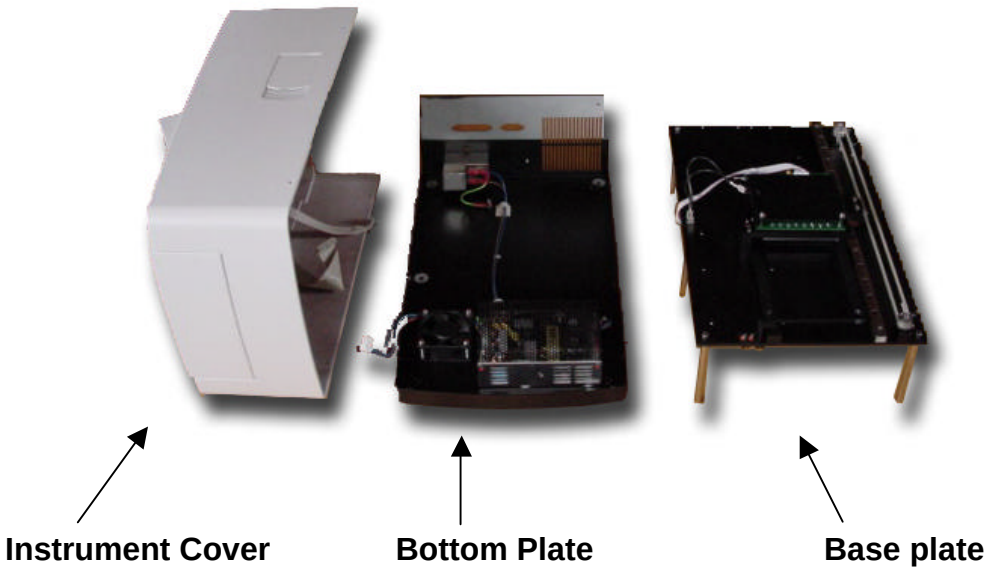
7.1 Introduction

This chapter will give instructions on how to replace parts and components of the instrument and how to perform adjustments that might be necessary after replacing parts.

Some parts and components of the instrument can be replaced with cover closed. Most parts, however, require at least a partial dis-assembly of the instrument.

7.2 Dis-assembly of Instrument

This chapter will give instructions on how to dis-assemble the instrument into the three main components



The **Instrument Cover** holds the keyboard and the display and contains the front lid (for light protection of optical system during plate reading) and the filter compartment lid (for easy access to the filter wheel).

The **Bottom Plate** holds the Mains connector with Power switch and Mains fuse holder, the Power supply unit and the cooling fan.

The **Base plate** holds the complete Optical system, the complete Plate transport and most of the electronic boards.

7.2.1 Remove Instrument cover

The instrument cover is mounted to the bottom plate by 6 screws:

= Cover screws

1. DANGER: Switch off the instrument and disconnect the power cable.

2. Remove these 6 screws using a 2 mm Hexkey.

3. Turn the instrument so that the font is towards you

4. Carefully lift the cover up and left:

The cover is now only connected to the instrument by the Display- and Keyboard cables. To completely remove the cover, disconnect these two ribbon cables from the instrument:

To re-assemble the cover, follow the above description, in reverse order.

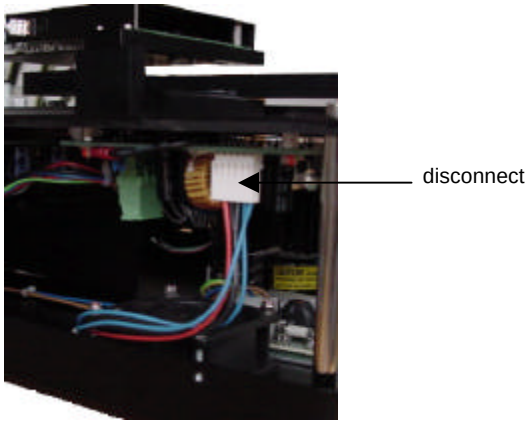
7.2.2 Remove Base plate from Bottom plate

After the cover has been removed as described in 7.2.1, the base plate can be removed. The base plate is mounted to the bottom plate by 5 screws, that can be accessed from the bottom of the instrument:

= Base plate screws

1. DANGER: Switch off the instrument and disconnect the power cable.

2. Remove the cover as described in 7.2.1
3. Remove these 5 screws using a 3 mm Hexkey.
4. Put the instrument back to normal position, so that the front faces towards you
5. Disconnect the cable between base plate and bottom plate (left side, front):



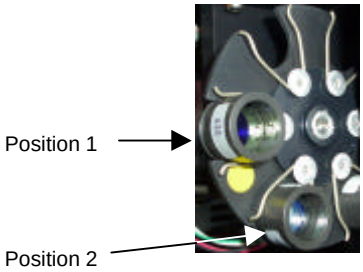
3. Slightly lift the front of the base plate for about 2cm
4. Now carefully pull the base plate towards you and lift it out of the bottom plate.

To re-assemble the base plate to the bottom plate, follow the above description, in reverse order.

7.3 Replace Filters

The instrument is fitted with up to 6 interference filters on a filter wheel. The filter wheel can be accessed by opening the filter compartment lid, located on the right side of the instrument:

The filters are held in place on the filter wheel by spring wires and can easily be replaced without using tools.



In order to prevent fingerprints, NEVER touch the glass surface of the filters !

The filter wheel has 6 positions, the position next to the yellow label is position 1. Each filter is labeled with it's specific wavelength. These wavelengths, with their position on the filterwheel are stored in the instruments memory. If an existing wavelength is being replaced by a new wavelength, the new value must be entered in the instrument's memory (see Chapter 4.3.2)

If defective filters are being replaced by new ones, please make sure to replace filters always only with filters of the same wavelength. It is recommended to replace filters always one by one only.

After replacing filters, a Calibration run must be performed (see Chapter 4.3.2)

7.4 Replace Mains Fuse

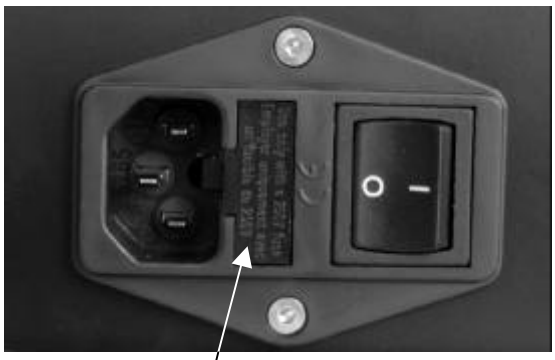
WARNING

Before replacing fuses, disconnect the power cord.

To avoid risk of fire, replace fuses only with same type and rating.

The following steps must be performed to replace the mains fuses, which are in mains receptacle bloc, in the rear panel of the instrument.

1. Switch off the instrument and unplug the power cord.
2. Open the plastic cover of the fuse compartment, by inserting a screw driver into the slot at the left side of the cover and pushing the cover out.

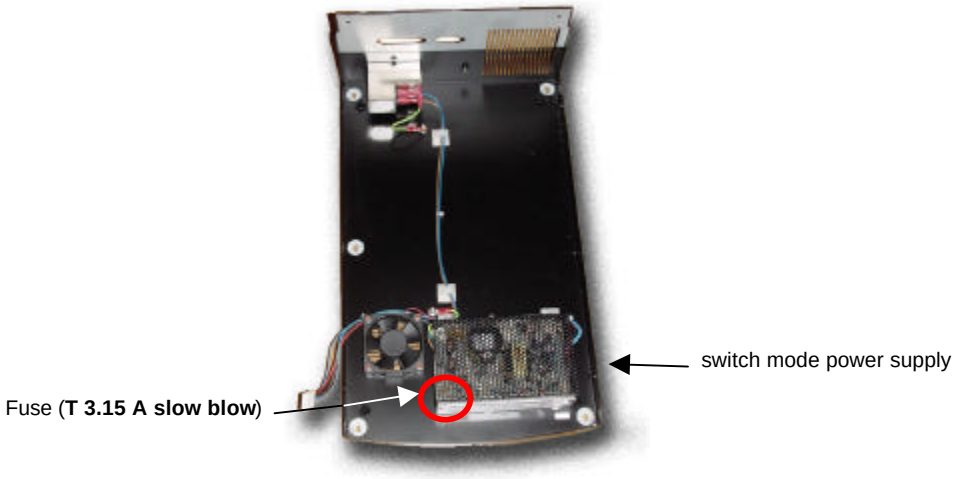


3. Pull the fuse holder out of the socket.
4. Replace the fuses only with the same type and rating.
5. Ensure that the fuse has the correct rating: **T 3.15 Amp (slow blow)**
6. Push the fuse holder back into the socket.
7. Reconnect the power cord and switch the instrument on.

7.5 Replace Power Supply Fuse

The power supply fuse is located on the switch-mode power supply board. Before this fuse can be accessed, the instrument cover, baseplate and bottomplate must be dis-assembled as described in Chapters 7.2.1. and 7.2.2.

The switch mode power supply is mounted to the bottom plate, and the fuse is at the left side of the power supply:

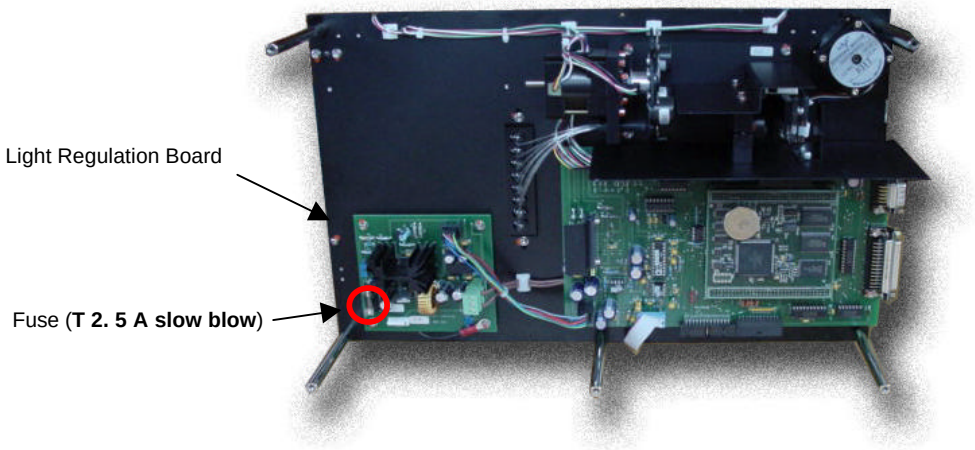


7.6 Replace Light Regulation Fuse

This fuse is protecting the 24V supply, used for the lamp and the stepper motors and is located on the light regulation board.

Before this fuse can be accessed, the instrument cover, baseplate and bottom plate must be dis-assembled as described in Chapters 7.2.1. and 7.2.2.

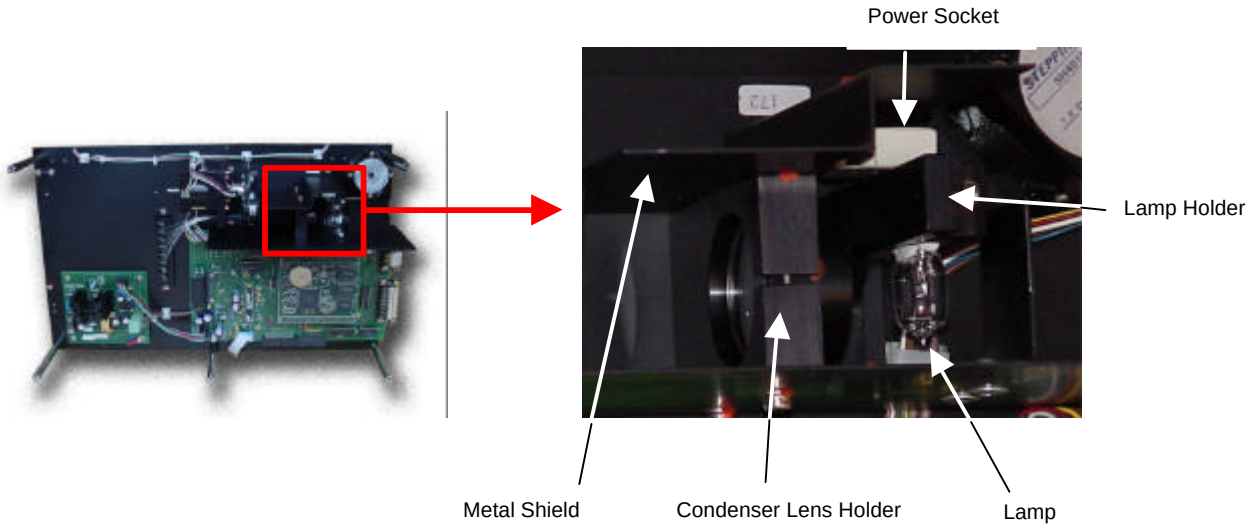
The light regulation board can be found at the bottom side of the base plate:



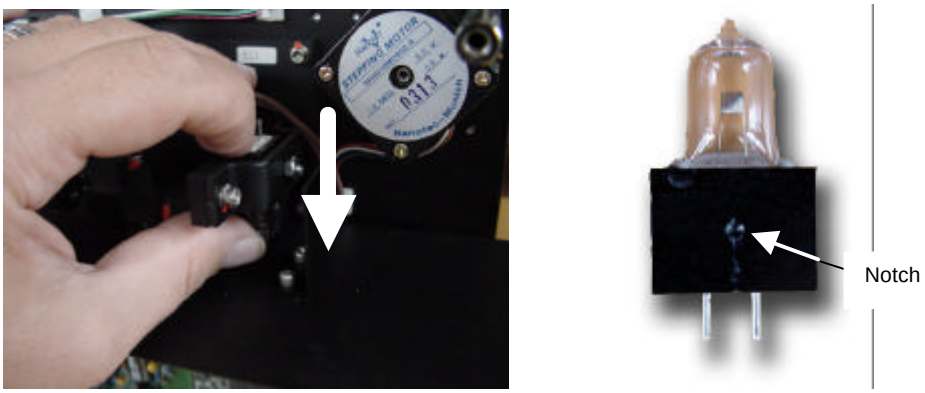
7.7 Replace Lamp

Before the lamp can be accessed, the instrument cover, baseplate and bottomplate must be disassembled as described in Chapters 7.2.1. and 7.2.2.

The lamp is mounted onto the bottom side of the base plate:



1. Remove the metal shield (see graph above) by removing the two screws that are holding it onto the condenser lens holder
2. Disconnect the power – socket from the lamp
3. Push the lamp out of the lamp holder:



4. The lamp is held in the right position by a spring loaded ball, which is snapped into a notch on the lamp socket.
5. Insert the new lamp, make sure that the spring loaded ball snaps into the notch of the lamp socket.
6. Re-assemble the instrument in reverse order.
7. After replacing the lamp, a Calibration run must be performed (see Chapter 4.3.2)
8. Also the digital values must be checked (see Chapter 5.3.3.1)

7.8 Replace Sensors

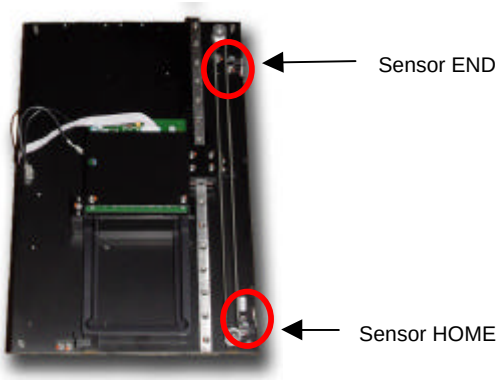
The instrument is fitted with three optical sensors:

- Transport Home
- Transport End

The sensors are always replaced in a full set. The full set of sensors includes the complete wiring, transport sensors HOME and END.

Before the sensors can be accessed, the instrument cover, baseplate and bottom plate must be dis-assembled as described in Chapters 7.2.1. and 7.2.2.

All sensors are mounted onto the base plate:



To replace the sensors, perform the following steps:

2. Unscrew the three sensors, using a 2.5mm hex-key.
3. Remove all sensors with the complete cable tree
4. Install the new sensors:
    a. Transport sensors: Both transport sensors have slot-holes. Both sensors must be mounted in a way so that the widest distance is given.
5. Place the base plate back into the bottom plate and re - connect the cable between base plate and bottom plate
6. Re-connect display and keyboard cable to the base plate
7. Connect instrument to mains power and turn the instrument on

ATTENTION: THE INSTRUMENT IS NOW CONNECTED TO MAINS POWER;

DANGER OF ELECTRICAL SHOCK !!

8. Perform a calibration of the transport system as described in Chapter 5.3.1.1
9. Re-assemble the instrument in reverse order.

7.9 Replace Boards

The instrument is fitted with five boards:

CPU Board

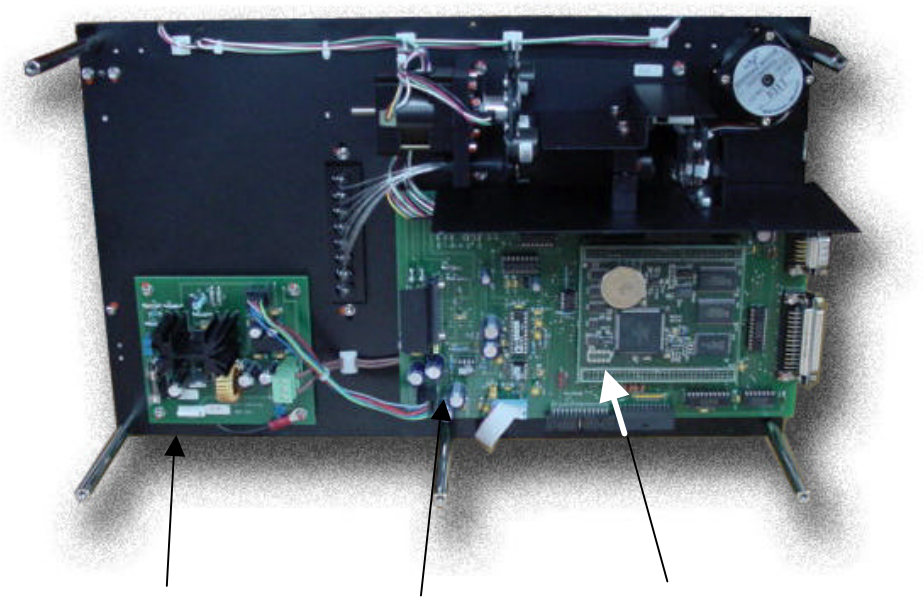
Interface Board

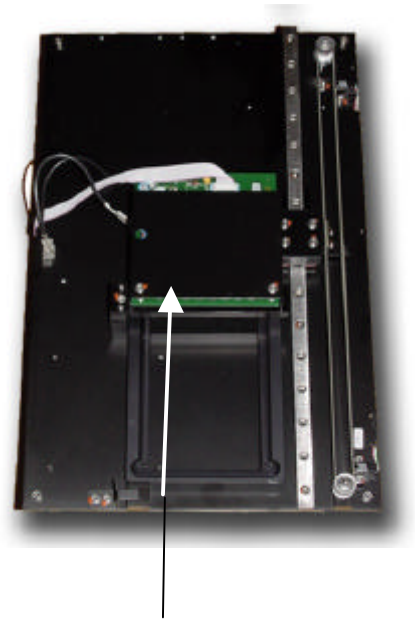
Pre - Amplifier board

Power Supply

Light intensity regulator

The boards can be located as follows:





7.9.1 Replace the CPU board

All plate data, methods and important instrument setup data are stored in the memory components of the CPU board. Therefore it is important to save these data before a CPU board will be changed. This is only possible when the CPU board is at least partially functioning.

On the Service CD, you find the required programs for backup and restoring CPU data.

In case the CPU board is completely non-functional, a set of default data should be loaded into the replacement board (see 7.9.1.4) and the plate transport as well as the filterwheel must be adjusted.

7.9.1.1 Data Backup

1. Connect the reader to the computer, switch the reader on, insert the Service CD into the CD Rom drive of the computer.
2. Double-click on VrBackup.exe (from the service CD) to start the Backup program. At the end of the procedure the screen will show 'Successfully finished ..'.
3. Now the CPU board can be physically replaced.

7.9.1.2 Physically replace CPU board

Before the Interface board can be accessed, the instrument cover, baseplate and bottom plate must be dis-assembled as described in Chapters 7.2.1. and 7.2.2.

The CPU board is located on the bottom side of the base plate, it is "sitting" on the Interface board.

1. Carefully lift the CPU board from the connectors that hold it onto the Interface board.
2. Carefully insert the new CPU board into the sockets

Make sure for the right direction: 

3. Re-assemble the instrument
4. Now the CPU board data must be restored

7.9.1.3 Restoring the original Data (if a backup as in 7.9.1.1 was possible)

a. Connect the reader to the computer, switch the reader on, insert the Service CD into the CD Rom drive of the computer.
b. Double-click on VrRestore.exe (from the service CD) to start the Restore program. At the end of the procedure the screen will show 'Successfully finished ..'.
c. Now this CPU is a "Clone" copy of the old CPU board.

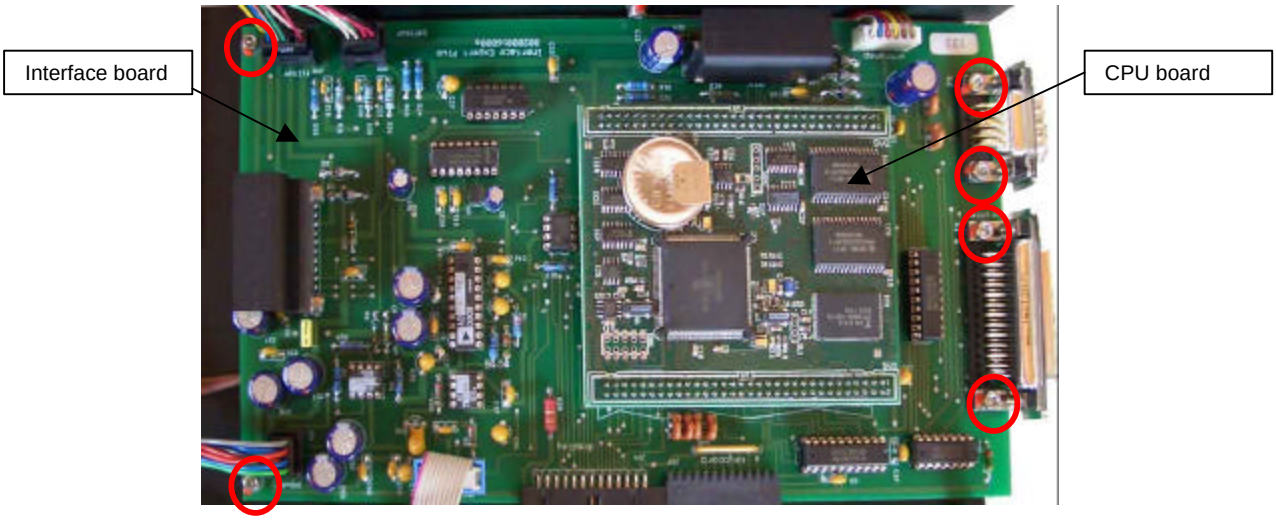
7.9.1.4 Restoring default Data (if a backup as in 7.9.1.1 was not possible)

1. Use VrRestore.exe (from the service CD) to start the Restore program. This will write a set of default data and the original Program version to the CPU board.
2. Calibrate both plate transport, and filter wheel (see 5.3.1.1 and 5.3.2.1).
3. Use the manufacturer's QC - plate to adjust the Plate Positions as described in 5.3.3.4
4. Check and, if necessary re-adjust the reading positions (see 5.3.1.2 and 5.3.3.4.)
5. Verify the correct position of the filterwheel:
    b. Open the filter compartment at the right side of the instrument
    c. Start the Service menu as described in 5.3.2 and select "Define Zero"
    d. Select Filter 1 and look at the filterwheel. Filter 1 (usually the 620 nm filter) should be exactly in the center of the light beam. When this is not clearly seen, you can check that filter 1 and filter 4 are at the same horizontal level.
    e. In case the position of filter 1 is not correct, you can move the position with the Up / down arrow keys. When the position is correct, press key F4 ' SET' to store the new position. Check the position again by pressing the Enter key, the filterwheel will make one revolution and should be at the same location as before.
6. Calibrate filters. (see 4.3.2)

7.9.2 Replace the Interface board

Before the Interface board can be accessed, the instrument cover, baseplate and bottom plate must be dis-assembled as described in Chapters 7.2.1. and 7.2.2.

The interface board is located on the bottom side of the base plate and "carries" the CPU board. It is mounted to the base plate with 6 hex-screws:



1. Carefully lift the CPU board from the connectors that hold it onto the Interface board.
2. Disconnect and remove the defective Interface board
3. Mount the and reconnect the new Interface board
4. Carefully insert the new CPU board into the sockets
5. Re-Assemble the instrument, there are no further adjustments required.

7.9.3 Replace the Power Supply board

Before the Power Supply board can be accessed, the instrument cover, baseplate and bottom plate must be dis-assembled as described in Chapters 7.2.1. and 7.2.2.

ATTENTION: Before touching the Power Supply Board, make sure that the power cord is disconnected from the instrument !

The Power Supply board is located in the bottom plate. It is mounted to the base plate with 4 screws, which can be accessed from the bottom side of the instrument.

To replace the Power Supply board, disconnect the cables, unscrew and replace the unit.

After the replacement, no further adjustments are required.

7.9.4 Replace the Light Intensity regulation board

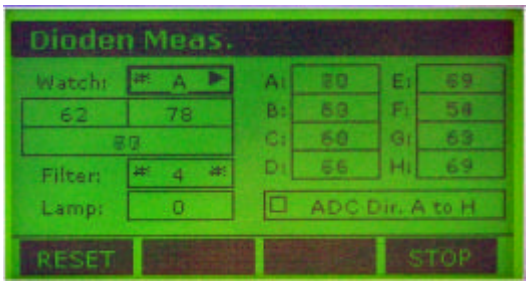
Before the Power Supply board can be accessed, the instrument cover, baseplate and bottom plate must be dis-assembled as described in Chapters 7.2.1. and 7.2.2.

The Light intensity regulation board is placed on the bottom side of the base plate with 4 hex screws. To replace the board, disconnect the cables, unscrew the board and replace It by the new board.

Adjustment:

The Light intensity board is fitted with one potentiometer, which defines the range for the light intensity and which is factory adjusted. To adjust this potentiometer after replacement of the board, start the Service menu “Dioden Test” as described in chapter 5.3.3.1.

When the display shows the following screen:



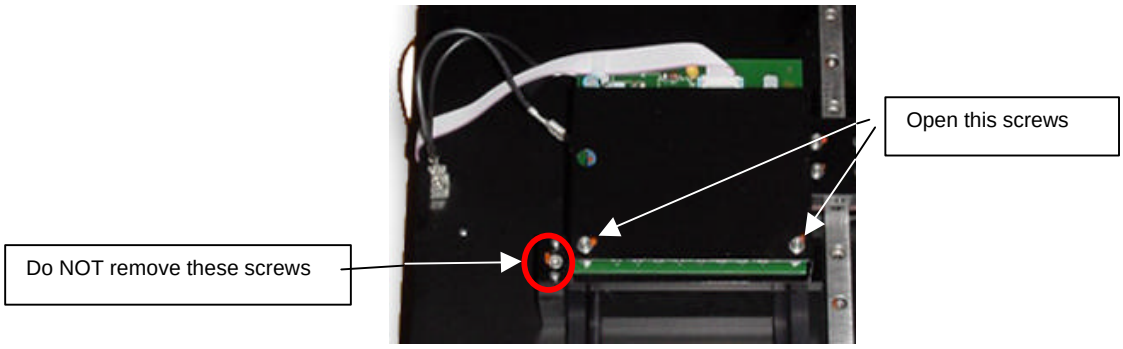
select the 620 nm filter (normally Filter #1 (please verify with your instrument).

Use the cursor up/down keys, until the field “Lamp” is selected. Using the numerical keys, enter 3650 as light intensity. Now adjust the potentiometer, so that the highest value is in the range of 60000 counts.

7.9.5 Replace the Pre-Amplifier board

Before the Pre-Amplifier board can be accessed, the instrument cover must be removed as described in Chapter 7.2.1.

The Pre-Amplifier board is placed on top of the open instrument, and is held in place by two hex screws.



Open the hex screws as marked above and lift board from the instrument. Mount the new board in reverse order.

The Pre-Amplifier board is fitted with one Potentiometer, which is factory adjusted.

7.10 Replace LCD display

The display is replaced complete with it's cable. Before the Display board can be replaced, the instrument cover must be removed as described in Chapter 7.2.1.

The display is mounted to the cover with 4 hex screws.

After replacing the display, adjust the contrast as described in chapter 4.3.4 "Display Contrast setting".

Chapter 8

Cleaning and Disinfection

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8.1 Introduction

This chapter gives instructions on how to clean parts, and how to properly maintain the instrument in order to assure longest possible functionality. Also the procedure for disinfection of the instrument is described.

8.2 Cleaning the instrument

This instrument is a precision instrument and the requires regular cleaning to ensure the continued precision.

Liquid Spills

If any liquid is spilled in the instrument, it should be IMMEDIATELY removed so that the liquid does not run in to the Optical System and causes a loss of accuracy.

Regular cleaning

The housing of the instrument should be cleaned regularly with a mild household cleaning agent.

Warning: Do not use aggressive solutions

8.3 Cleaning Filters

If an interference filter is dirty it needs to be cleaned. For the cleaning procedure you need low-lint cotton-tipped swabs and a lens cleaning solution or reagent-grade isopropyl alcohol.

First blow off dust and dirt with pressurized gas. Apply a few drops of the cleaner on both sides of the filter and wipe-off the dirt with the cotton swabs. Allow the cleaner to evaporate and then visually check the filter surface for streaks or spots. If required, repeat the procedure.

When streaks or spots are visible which cannot be removed by the procedure as described above most probably they are inside the filter. In such a case the filter must be replaced (see chapter 7.3).

Note: Interference filters do have a limited lifetime of a few years, depending on the humidity and ambient temperature. Under tropical conditions a filter may get unusable within less than two years.

8.4 Instrument Disinfection

All parts of the instrument that come into contact with patient sera or positive controls must be treated as potentially infectious.

It is very important that the instrument is thoroughly disinfected before it is removed from the Laboratory or any servicing is performed on it.

8.4.1 Disinfection Procedure

If the laboratory has no specific disinfection procedure, the following procedure should be used to disinfect the instrument.

The instrument should be disinfected using a suitable disinfection solution.

1. Disconnect the instrument from the mains power supply.
2. Disconnect the instrument from the computer.
3. Carefully wipe all the outside surfaces of the instrument and the plate support area with a wad of cotton wool that has been soaked in the disinfection solution.

   Ensure that disposable gloves are worn.
4. Place the instrument in to a large plastic bag.
5. Place a wad of cotton wool that has been soaked in the disinfection solution in to the plastic bag.

   Ensure that the wad is not touching the instrument.
6. Close and seal the plastic bag.
7. Leave the instrument to stand in the plastic bag for at least 24 hours.
8. After the standing time, remove the instrument from the plastic bag and wipe all the outside surfaces of the instrument and the plate support area with a wad of cotton wool which has been soaked in a 50% Alcohol solution.
9. Repeat the disinfection procedure on any accessories which are also being moved or returned.

Chapter 9

Circuit Diagrams

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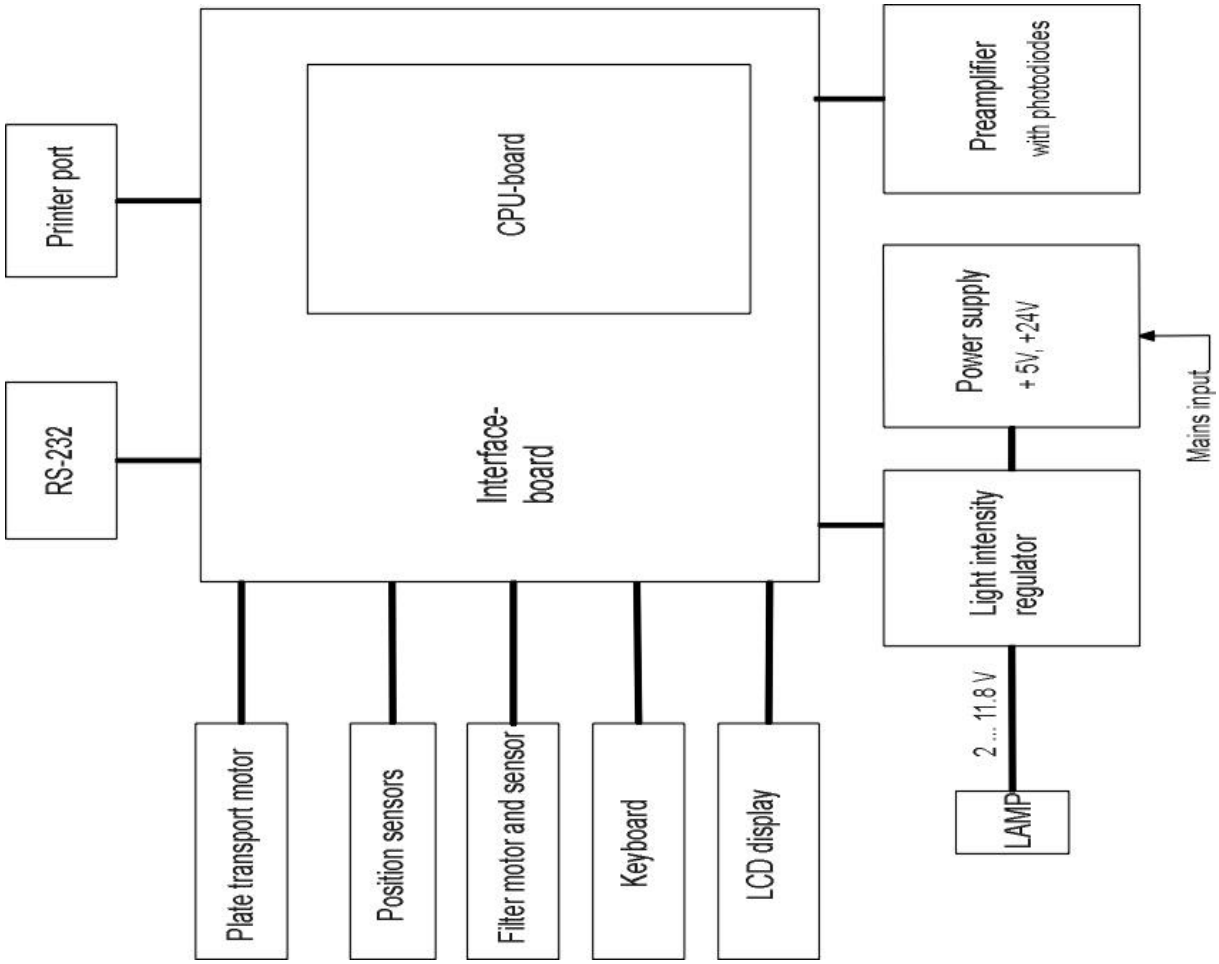
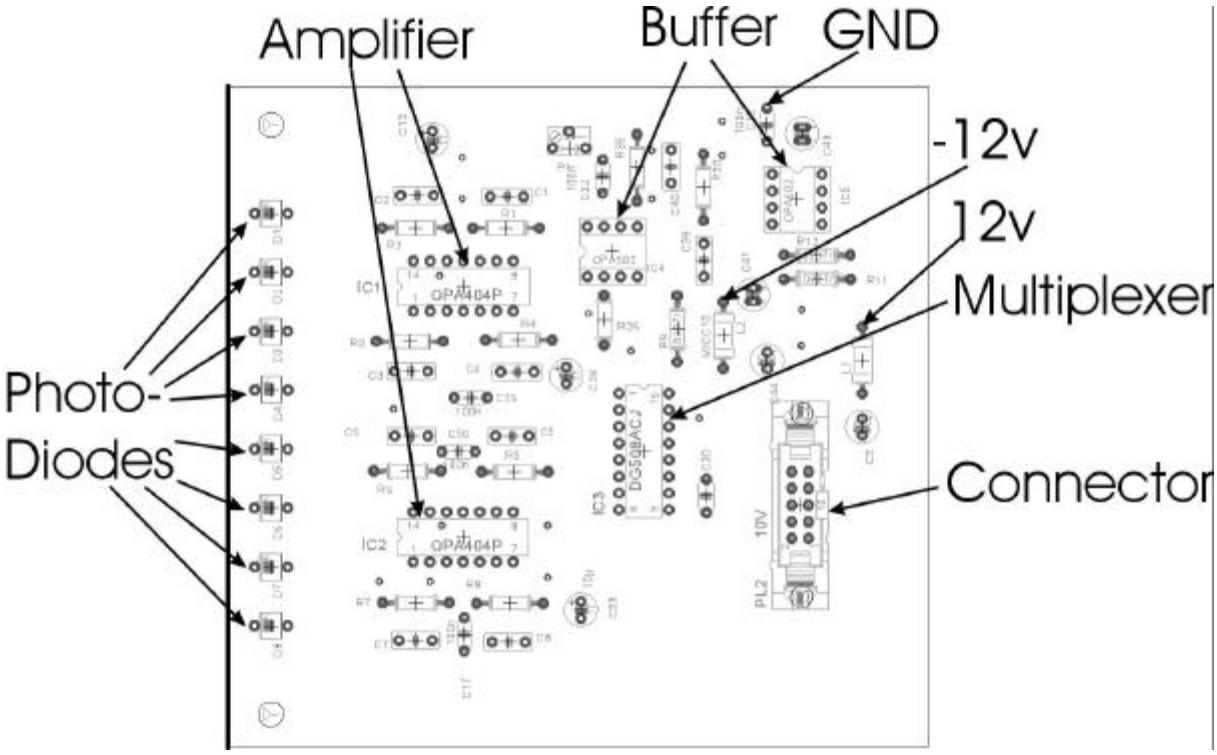
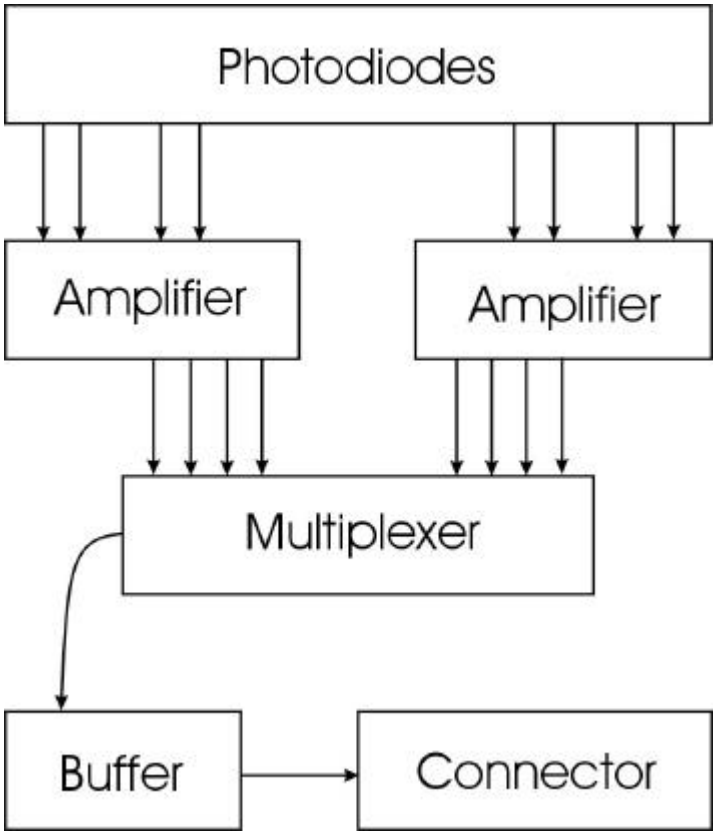
9.1 Block Diagram

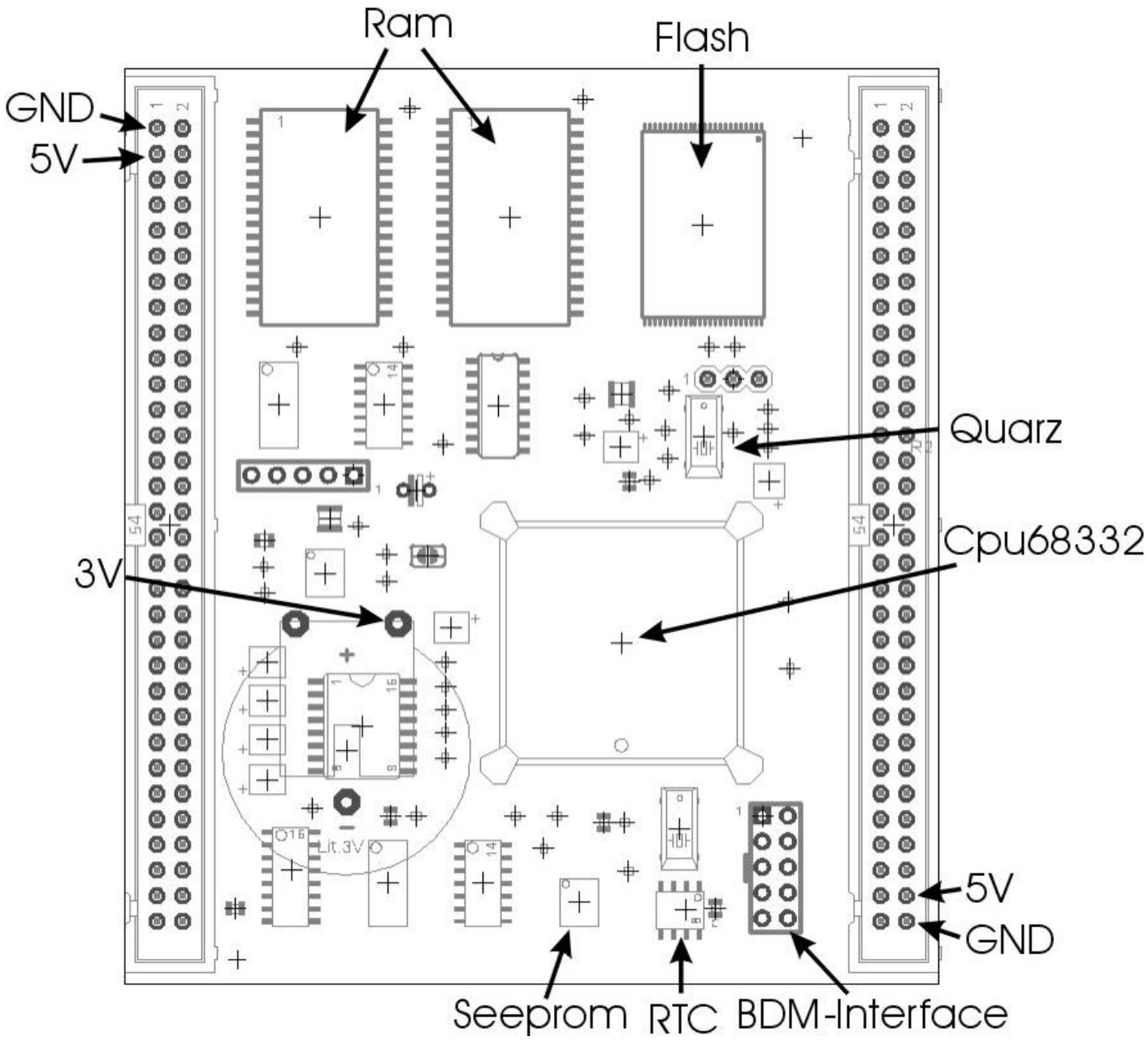


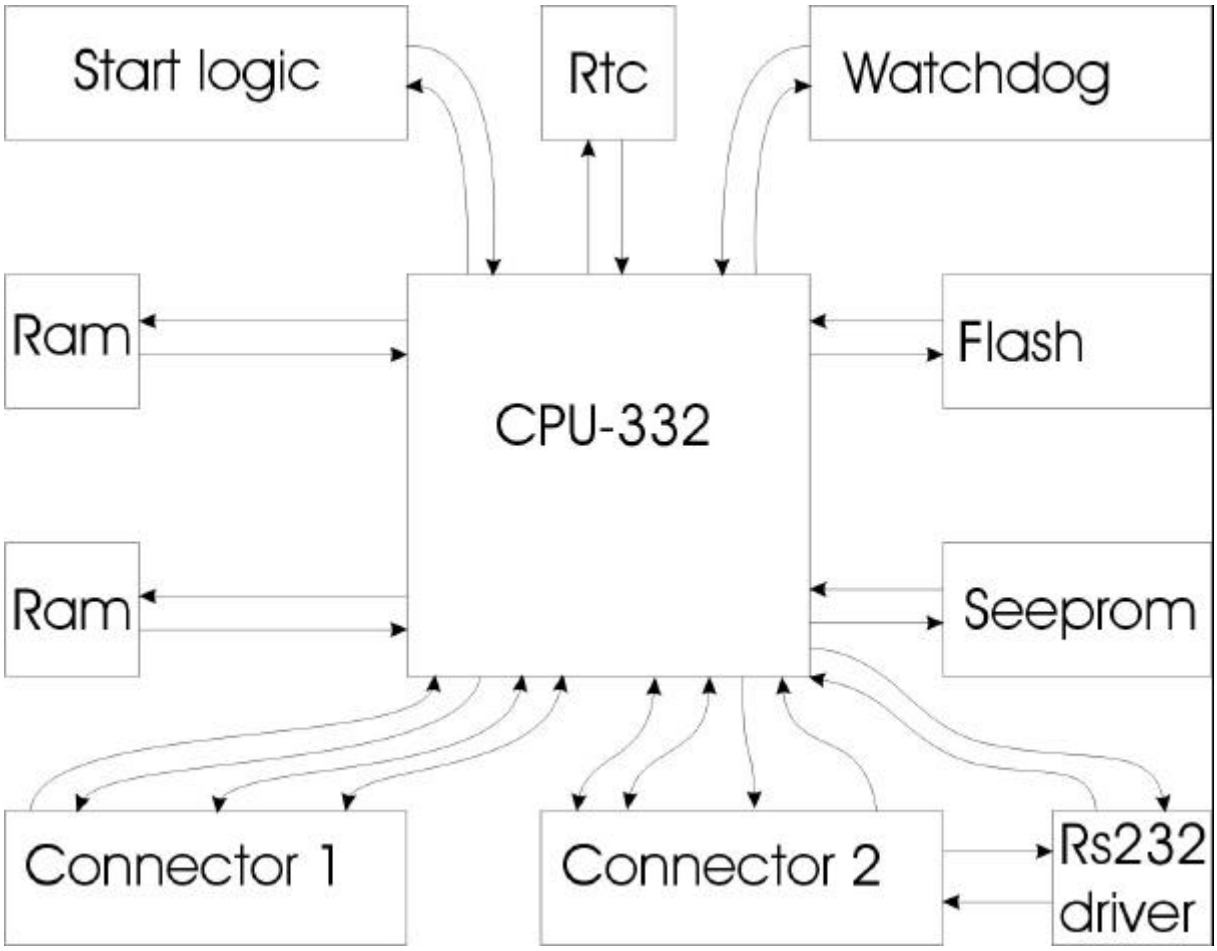
9.2 Pre-Amplifier board



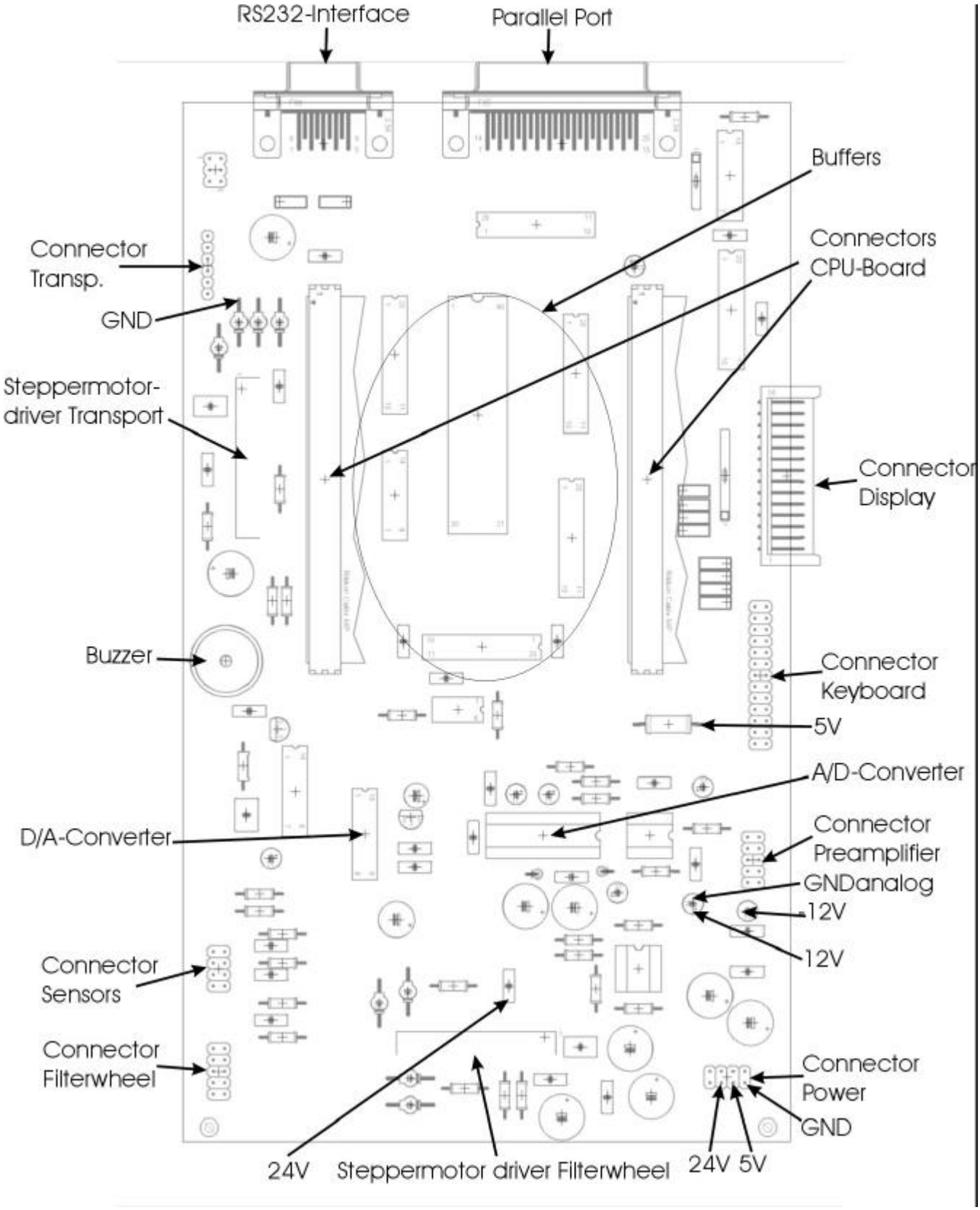


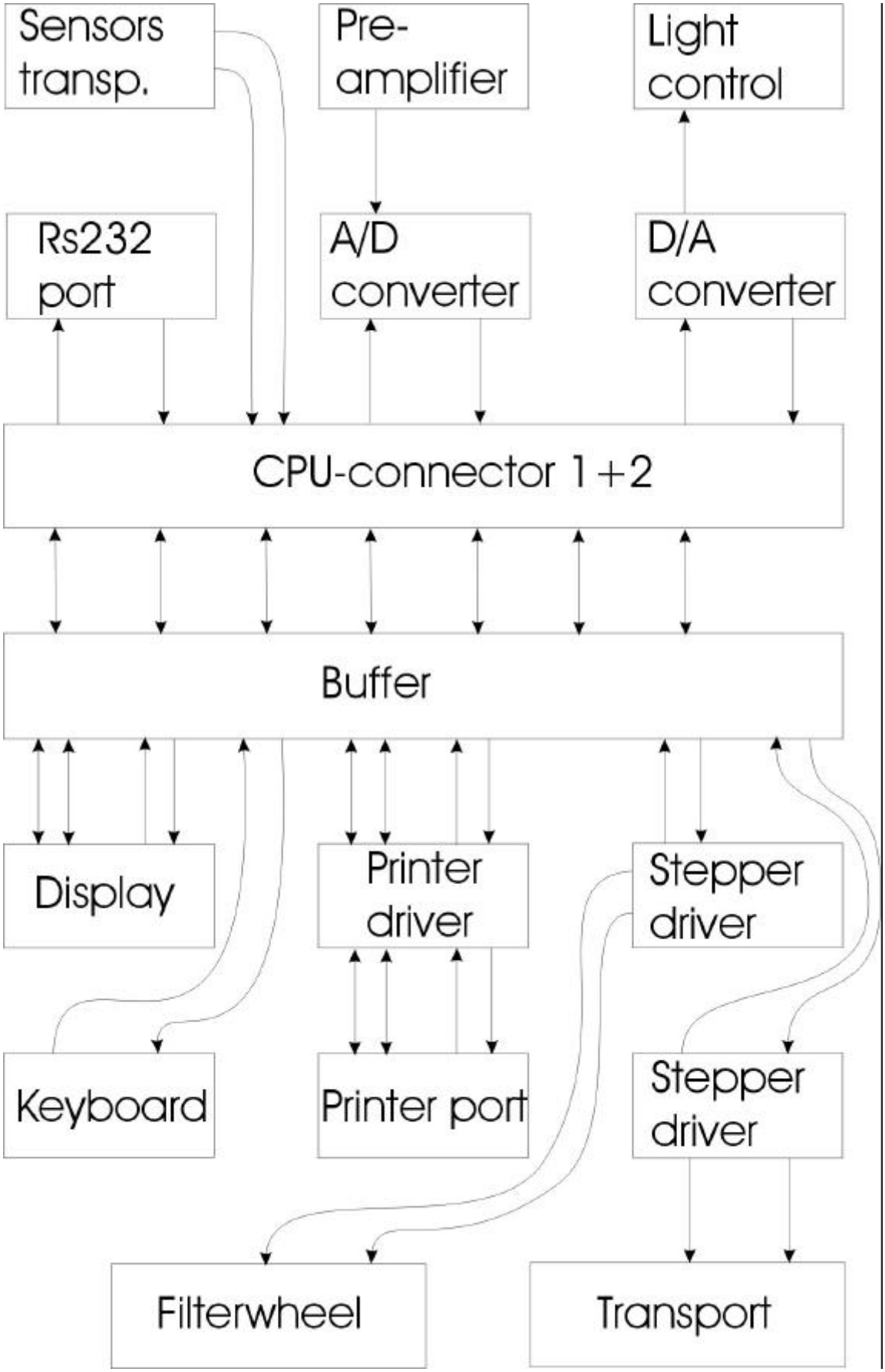
9.3 CPU board


Ram
Flash
GND
5V
Quarz
Cpu68332
3V
5V
GND
Seeprom
RTC
BDM-Interface

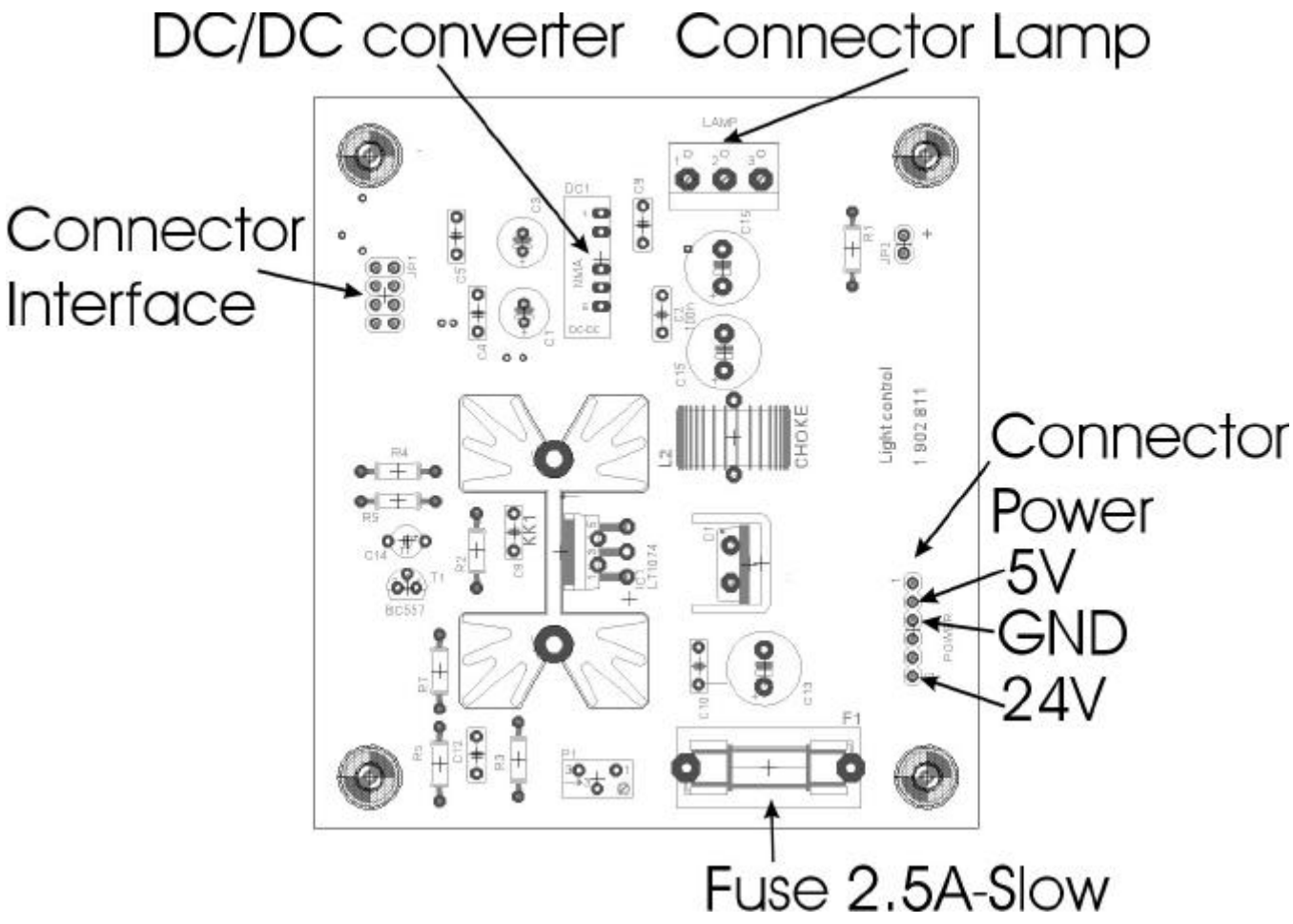

Start logic
Rtc
Watchdog
Ram
CPU-332
Flash
Ram
Seeprom
Connector 1
Connector 2
Rs232
driver

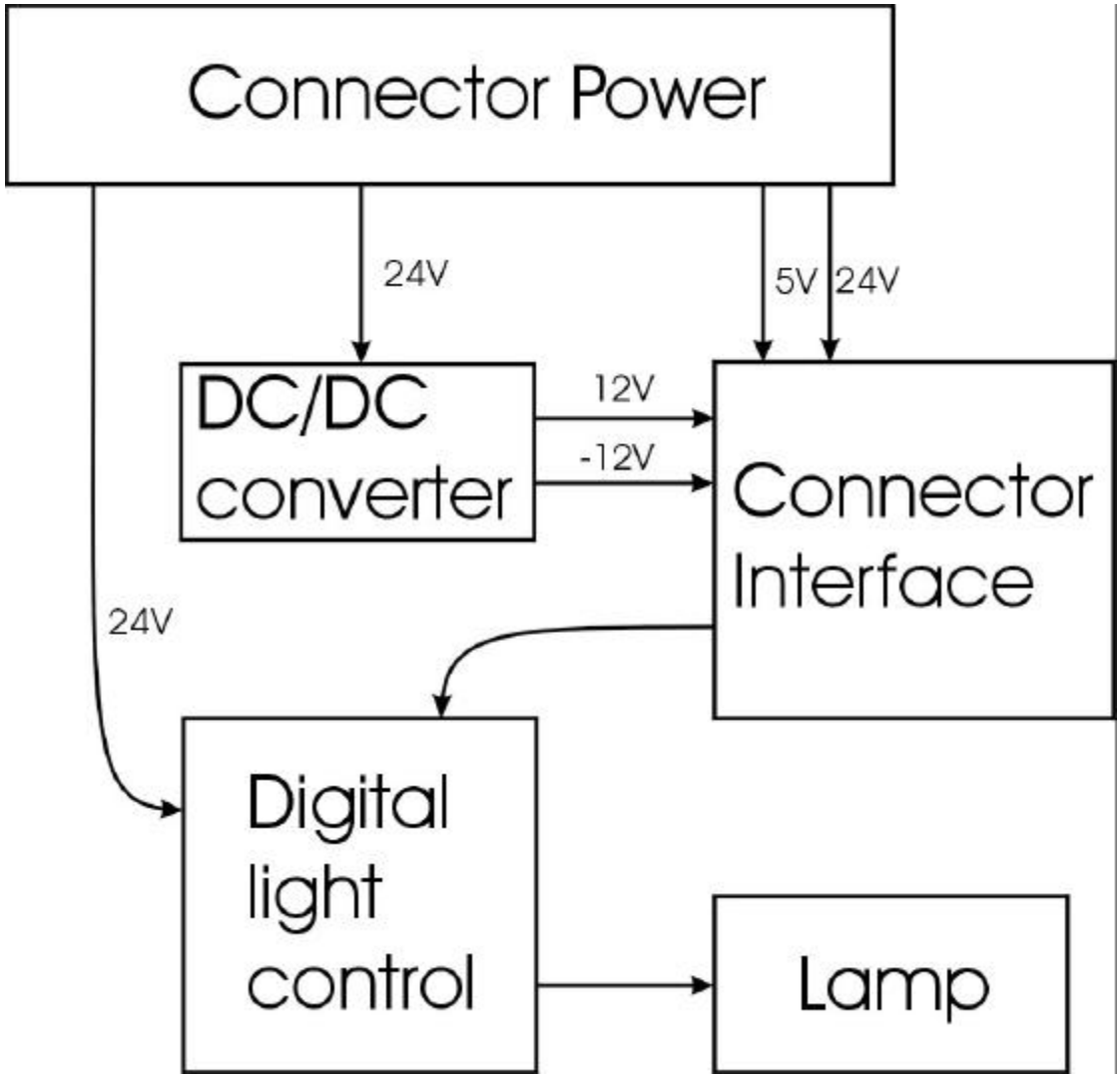
9.4 Interface board




Sensors transp.
Pre-amplifier
Light control
Rs232 port
A/D converter
D/A converter
CPU-connector 1+2
Buffer
Display
Printer driver
Stepper driver
Keyboard
Printer port
Stepper driver
Filterwheel
Transport

9.5 Light Intensity regulation board




Connector Power
24V
5V
24V
DC/DC converter
12V
-12V
Connector Interface
24V
Digital light control
Lamp

Chapter 10

Performance Verification

QC Plate:

To check the performance of the Instrument, we recommend to use the Manufacturers QC - plate with the QC - software. The QC - plate checks the mechanical alignment of both the plate transport and the optical path and tests the accuracy and precision.

The QC-plate consists of a precise milled aluminum body in the dimensions of a standard microplate and three neutral density glass filters. In contrast to other neutral density filters the sensitive coated area is protected by another glass layer, avoiding the known problems with scratches and degradation caused by frequent cleaning. The neutral density filters cover all of the eight measurement channels.

For instructions how to use the QC-plate and - software see the manual which comes with the QC-plate.

Orange Test Plate:

An alternative to the QC-plate is the so-called 'Orange Test plate'. The results obtained with this plate are not as accurate as with the QC-plate but usually sufficient for service purposes.

The "Orange Test Plate" is a simple tool to check the correct wavelength and function of an interference filter. This is performed by comparing the enclosed reference OD data with OD data obtained by a measurement using the filter in question.

Furthermore the results of the measurement can demonstrate the correct function of the reader.

Note: The correlation of the reference data with the measured data is no 100% proof of the correct wavelength.

Operation of the Orange Test Plate

1. Make sure that the surface of the plate is free of dirt and fingerprints.

2. Perform single wavelength measurements with the filter in question and print the results.

3. Compare the results with the reference data. The results should be within +/- 20% and +/- 0.005 OD of the reference data for the wavelength used. If the result is off, most likely the filter is defective or has a wrong wavelength.

4. Check for similar readings in the 8 rows. There should be no more than +/- 6 % and +/- 0.005 OD difference between the readings of different rows in the same column. If the difference is higher, then the filter is likely to be defective. You may see irregular spots or rings if you look through the filter into a light source.

NOTE: For a complete performance check of the Instrument use the QC - plate with the QC-software.

Chapter 11

Recommended Spare Parts

Description	part no.
Preamplifier board	B 020 015
Interface board	B 020 016
CPU-board	B 020 017
Power supply	6 200 121
Light intensity regulator board	B 018 011
LCD-display	6 110 003
Lamp	B 011 016
Lamp UV	B 010 118
Keyboard	1 350 206