

OPTIMAX 2010 NDT

Automated X-ray film processor

Model/ID: 116x-x-xxx0

User Manual

Ident. Nr. 5163-0-0002



CE

**NOTE**

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**NOTE**

The information contained in this document conforms to the configuration of the equipment as of the date of manufacture. Revisions to the equipment subsequent to the date of manufacture will be addressed in service updates distributed to the PROTEC Technical Service Organization.

Document Effectivity

Revision No.	Date	List of effective pages	Comments
4.0	26/11/2018	all	new pumps, new main drive, new document layout
5.0	17/04/2019	22, 53,	Warning hot air new, max. power consumption in processing changed to 2,0.
6.0	2021-11-21	53	Filmformats corrected and described in more detail.
7.0	2023-06-28	Chap. 5.2.9	Listing updated
8.0	2023-08-02	Page 45	CAUTION new
9.0	2025-02-19	Chap. 6.2.3	Securing latch blue deleted
10.0	2025-07-16	All	First edition PROTEC X-ray Systems GmbH

General Notes

Mechanical – Electric Warning

**WARNING!**

All of the movable assemblies and parts of this equipment should be operated with care and routinely inspected in accordance with the manufacturer's recommendations contained in the equipment Accompanying Documents. Maintenance and service is only to be performed by Customers authorized by PROTEC X-ray Systems GmbH. Live electrical terminals are deadly.

To the User

**NOTE**

The user of this Document is directed to read and carefully review the instructions, warnings and cautions contained herein prior to beginning operation, installation or service activities.

While you may have previously operated equipment similar to that described in this Document, changes in design, manufacture or procedure may have occurred which significantly affect the present operation.

Although the product was subject to a risk analysis and the design corresponds to the current state of the art, residual risk will remain in clinical use. These are displayed in the following user manual by application limitations, contraindications, warnings and precautions.

The installation and service of equipment described herein is to be performed by authorized, qualified **PROTEC X-ray Systems GmbH** Customers.

Assemblers and other Customers not employed by nor directly affiliated with **PROTEC X-ray Systems GmbH** technical services are directed to contact the local **PROTEC X-ray Systems GmbH** office before attempting installation or service procedures.

**NOTE**

The usage of the product in combination with accessories which aren't authorized by PROTEC is forbidden.

1 Product description

1.1 Introduction

This user manual describes the special features and operational aspects of the OPTIMAX 2010 NDT, knowledge of which are required for efficient and effective use of the radiographic system.

Prior to working with the automated X-ray film processor OPTIMAX 2010 NDT, it is required that the user read the Safety Notes as well as the chapter regarding operation.

1.2 Description

The automated X-ray film processor OPTIMAX 2010 NDT is a laboratory device used for the automatic development of X-ray films in the non-medical field, material testing.

The device is equipped with a precise roller transport system that can process sheet films. The automatic movie recording starts as soon as a film is entered into the feeder. The film materials are developed, fixed, watered and dried. With the easy-to-use microprocessor control, the processing conditions can be adapted to a wide variety of films and chemicals. The developer and fixing solutions are regulated in their temperature, circulated and automatically regenerated.

These operating instructions give you important information on the installation, operation and maintenance of the device. Please note the information given to ensure the reliable operation of your OPTIMAX 2010 NDT.

Optional accessories

The following optional accessories are available for the automated X-ray film processor

Processor stand 1267-0-0000

1.2.1 Installation

See chapter 3.

Contact information's of persons which are qualified to make installations are request able at:

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Internet: www.protec-med.com

1.3 Product specific characteristics

- Memory for 2 programs
- Variable processing speed
- Adjustable dryer heating
- Overflow protection
- Water save mode selectable

1.4 Intended use

The automated X-ray film processor OPTIMAX 2010 NDT is intended for the automatic development of X-ray film in the non-medical field, material testing (non-destructive radiographic tests).

1.5 Intended user group

The automated X-ray film processor OPTIMAX 2010 NDT is exclusively designated for use by professional who are trained, in accordance with the corresponding national regulations, in the use of diagnostic X-Ray equipment and its proper (certified) use in connection with other objects and accessories.

1.6 Conformity



This product is in conformity with the requirements of the European Community Medical Device Directive 2006/42/EC, including all valid amendments to the date of issue.

The declaration of conformity is available directly from PROTEC:

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In den Dorfwiesen 14 | 71720 Oberstenfeld
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E-Mail: protec@protec-med.com
Internet: www.protec-med.com

2 Safety Instructions

**NOTE**

Contains information that are relevant to the usage.

xxx

**CAUTION!**

Contains information that can cause damage to properties at non conformity.

xxx

**WARNING!**

Contains information that can cause personal injuries at nonconformity.

xxx

Adjustments and calibrations that are described within the user manual must be made, with the aid of The technical description for the system, by the **PROTEC X-ray Systems GmbH** customer service department or a PROTEC X-ray Systems GmbH authorized service technician.

**NOTE**

Every delivered manual has to be read and the safety notes have to be observed.

**CAUTION!**

The manual contains every safety relevant information's for the commissioning of the OPTIMAX 2010 NDT. Operating the device is exclusively for special trained staff. In this context there are on every operating element relevant safety symbols. Further information's are on the delivered document-CD. Those information's count as additional information's and have to be observed.

**NOTE**

Every operating elements are descript in the corresponding manual.

2.1 General safety notice

2.1.1 Requirements for operation

To ensure the safe operation of this processor, installation and use should always conform to the instructions contained in this manual.



WARNING!

Non-diluted chemicals are caustic. For this reason, chemicals should be handled very carefully. Avoid contact with skin, always wear protective clothing, gloves and glasses when handling the chemicals.



WARNING!

Inhalation of chemicals can be dangerous to your health and should be avoided. For this reason, always ensure that the room in which the processor is installed is adequately ventilated.



WARNING!

Also when taking the racks out for cleaning or servicing. In case of chemicals getting into the eyes, rinse eyes immediately with cold, running water for approximately 15 minutes, and contact a doctor afterwards.

The developer and fixer chemicals used in the processor should be handled according to the manufacturer instructions. In general: Non-diluted chemicals are caustic. For this reason, chemicals should be handled very carefully. Avoid contact with skin, always wear protective clothing, gloves and glasses when handling the chemicals - for example, when mixing and refilling. Also when taking the racks out for cleaning or servicing. In case of chemicals getting into the eyes, rinse eyes immediately with cold, running water for approximately 15 minutes, and contact a doctor afterwards. Inhalation of chemicals can be dangerous to your health and should be avoided. For this reason, always ensure that the room in which the processor is installed is adequately ventilated.

Environmental regulations regarding the storage and disposal of waste chemicals should be obtained from the local water authorities and complied with.

Before opening the processor switch off the unit and unplug it from the electrical socket. Service and repairs must be performed by trained service technicians only. Use only manufacturer replacement parts.



WARNING!

**Class I ME device (according EN 60601-1).
To reduce the risk of electric shock, this unit is designated exclusively for connection to a supply network with protective earth.**

2.1.2 Operating of the radiographic system

When having troubles with operating of the OPTIMAX 2010 NDT, immediately call the Service of PROTEC or an authorized service and stop the using of the OPTIMAX 2010 NDT.

2.1.2.1 Operating type

The automated X-ray film processor is designated for continuous use.

2.1.3 Operating personnel

The OPTIMAX 2010 NDT should only be operated by personnel who are trained in accordance with the corresponding national regulations in the use and operation of diagnostic X-Ray systems.



NOTE

Only properly trained and authorized personnel are allowed to work with the automated X-ray film processor OPTIMAX 2010 NDT.

The user, as well as the service personnel, must pay attention to the warnings, notices and safety instructions located on the device and in the user manual. Failure to comply with the information provided can lead to injury.



NOTE

Operating personnel are required to acquaint themselves with all warnings (warning signs) located on the device. They serve to ensure the safety of the operator as well as others and set a basis for orderly operation.

2.1.4 Ventilation



WARNING!

Inhalation of chemicals can be dangerous to your health and should be avoided. For this reason, always ensure that the room in which the processor is installed is adequately ventilated.

2.1.5 Interaction with external devices

Unwanted interaction with external devices is not known.

2.1.6 Electromagnetic Environment and the influence of devices

The automated X-ray film processor OPTIMAX 2010 NDT is intended for the usage in a professional environment of material testing.

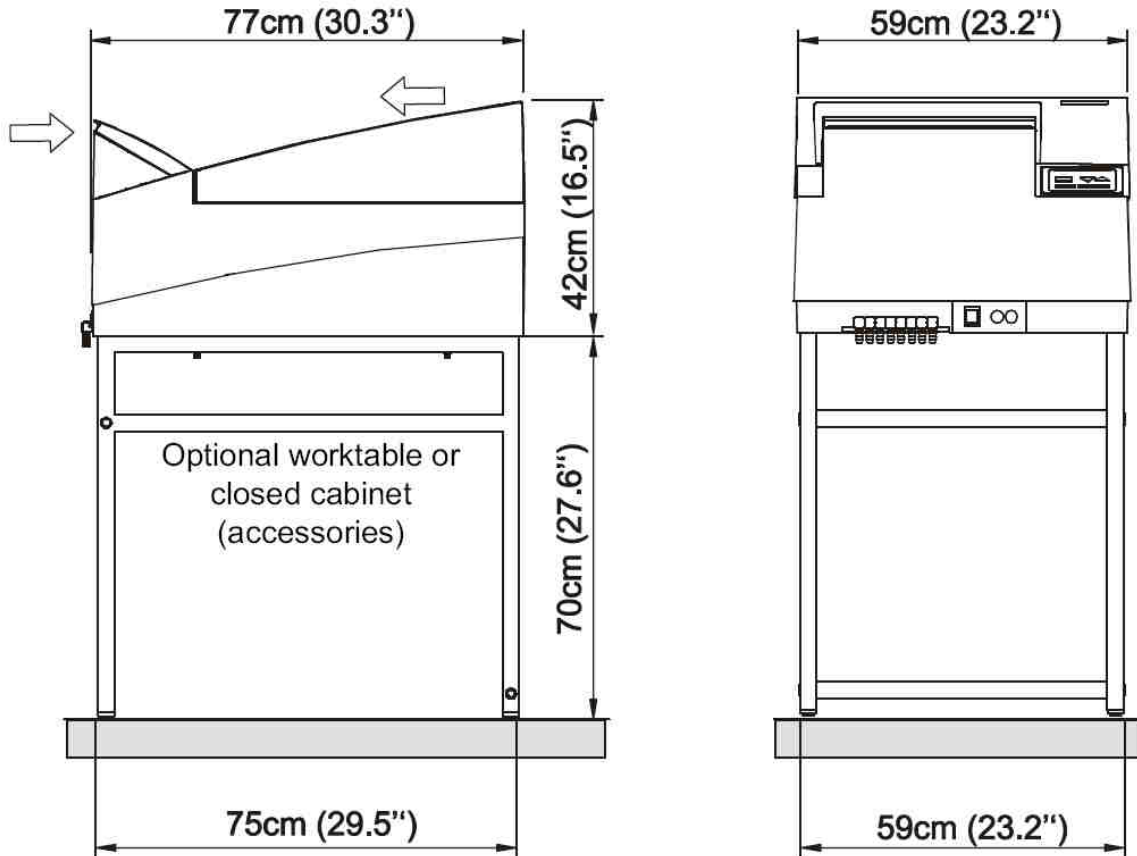
3 Installation



WARNING!

Electrical connections should be carried out according to regulations by an electrician.

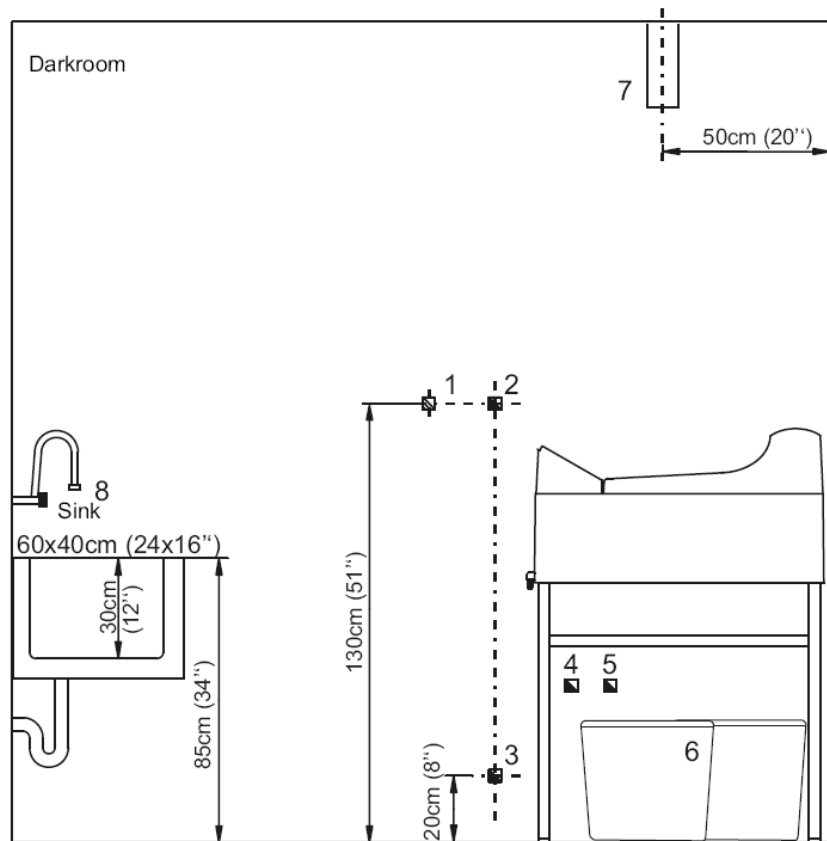
3.1 Requirements for installation



- Fresh water connection: Stop cock with 3/4" outer-thread diameter (washing machine connection), Water pressure 2 - 10 bar (29 - 145 psi).
- Drainage connection: Plastic tube - inner diameter 50 mm (2") or larger. A ventilated syphon which serves as odour preventor should be included in the planning. The drainage tubes should be installed with a fall of minimum 5 %. Local Water Authorities regulations should be complied with.
- Electrical connection: Fused wall socket with earth connection according to electrical data (see technical specifications, see 10). It is also required to install an earth-leakage switch (with 25 A / 30 mA nominal error current).

1. Wall socket
220-240 V, 16 A

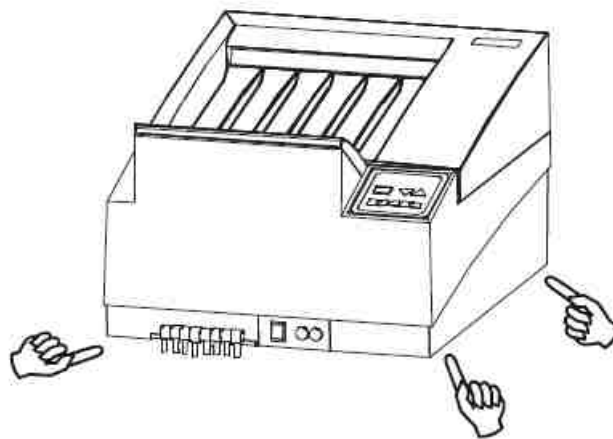
(model). Power lead should be equipped with Earth-Leakage Switch, 25 A / 30 mA nominal error-current. In addition, a power control switch can be installed.
2. Fresh water connection 3/4" with stop cock, permissible pressure 2-10 bar, water temperature 5-25 °C.
3. Wasserabfluß PVC-Rohr \varnothing 50 mm (2") mit Siphon.
4. Drainage resp. collecting containers for used developer.
5. Drainage resp. collecting containers for used fixer.
6. Storing space for replenishment tanks: Below machine or externally.
7. Ventilation of darkroom is necessary.
8. Sink with freshwater and flexible hose. Inner dimensions minimum (LxWxH) 60x40x30 cm (24x16x12").



Measures and positions are recommendations

3.2 Transport

Due to the weight and dimensions of the film processor OPTIMAX 2010 NDT should always be carried by two persons. To do so, hold the machine at the sides on the bottom (see figure). While putting the machine down, watch the position of the levelling feet to prevent damaging these.



3.3 Installation of processor

Unpack the Processor. Remove cover and transport securing brackets on the sides of the roller racks. Remove roller racks - start with the dryer rack.

In the standard version the OPTIMAX 2010 NDT is delivered as a tabletop processor with a two part floor plate. If the machine is upgraded with the optional stand or cabinet, the narrow plastic part has to be removed.

3.3.1 Table-top installation

In the event that the processor is to be installed on a work top or table, the four adjustable feet should be screwed on.



WARNING!

Machine should not be installed on table-top without adjustable feet, as this would block the ventilation openings under the machine and cause overheating.

3.3.2 Installing on processor stand or base cabinet

In the event that the processor is to be installed on the stand or cabinet (optional accessory), the processor will be mounted directly to it. Mount processor according to manual included with stand or cabinet (the adjustable feet inside the accessory bag are not required).

3.4 Finally the processor needs to be levelled:

Place spirit level across the sidewalls of processor and adjust the levelling feet accordingly. Replace the racks into the processor and close the latches.

3.5 Connecting the processor



NOTE

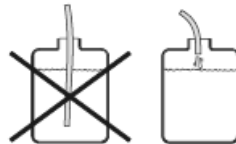
Inform yourself of the local water board regulations regarding drainage. These regulations may differ from information in this manual, but they should be complied with.



WARNING!

Danger of Overflow!

Use the included cable binders (accessory bag) to secure the hoses. Fix all hose ends which guide into syphon or collecting container, so that they do not drop into the liquid.

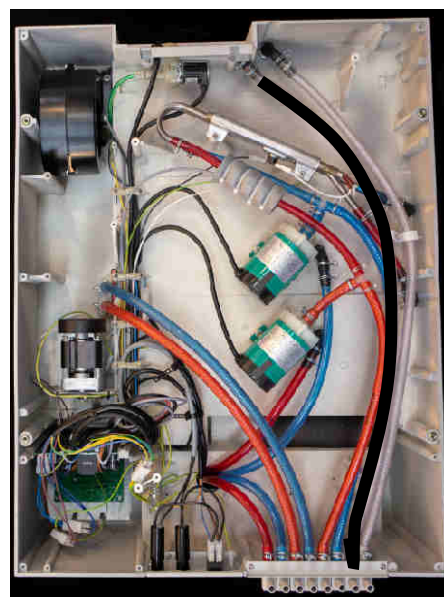
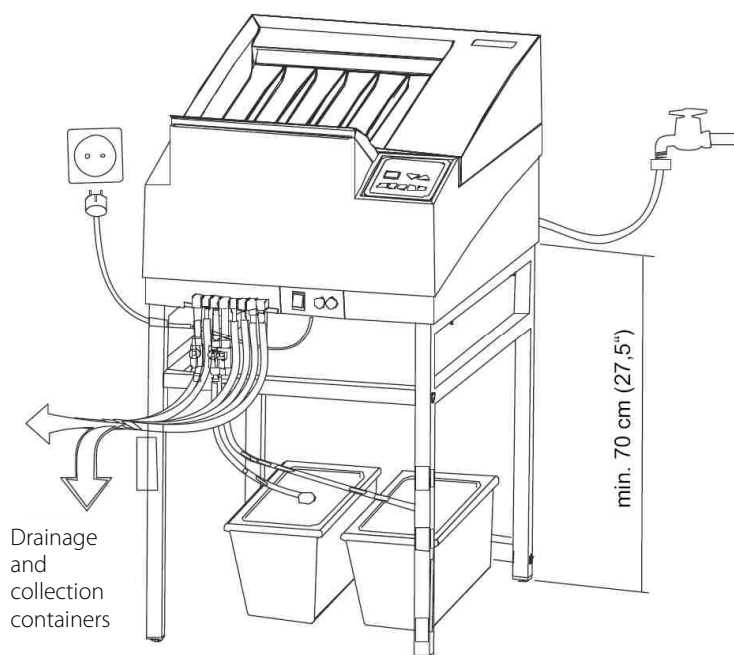
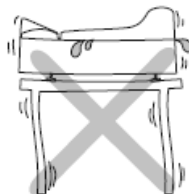


WARNING!

The hose piping should be straight (without the hoses going up and down) with a constant fall. The hoses should be as short as possible and without bends and kinks. This is very important for the water overflow hose. Bad piping work will cause the machine to overflow!

**WARNING!**

If the machine is installed table-top, ensure that the table is stable enough and does not wobble.

**3.5.1 Water connection**

Fit water-inlet hose (grey) at the rear of the machine and connect to the prepared fresh water supply.

3.5.2 Water overflow

The water overflow hose ($\varnothing = 16\text{mm}$) is likewise connected at the rear of the unit. The hose is installed as described in the next section.

There are two options for installation of the water overflow at the front of the unit. Install the pre-assembled hose in the unit and connect it to the overflow outlet at the unit front. Upon delivery this outlet connection is a dummy only (see graphics on the top right).

All other hoses (see graphic 3.5.3). Connect the enclosed hoses according to colour system onto the front of the machine. Put hose clip (enclosed in accessory bag) over hose end, before attaching to connection. Warm up hose end (with hot water or hot-air fan) and push it onto the respective connection. Finally push clip over hose and connection.

Cut hoses to required length. Then integrate the stop cocks into the three drainage hoses in such a position, that they are easy to reach.

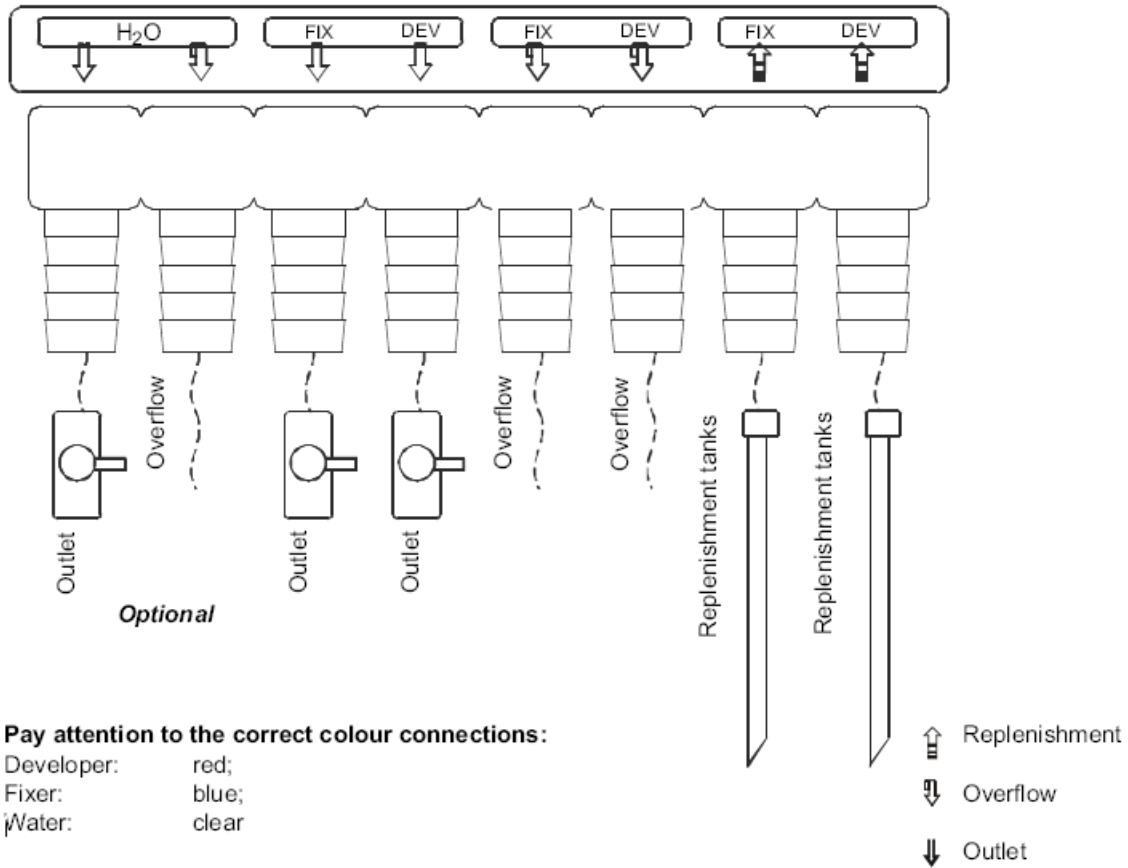
Connect the suction pipes to the hose ends for the replenishment tanks using hose clips. Put suction pipes through cover opening into respective replenishment tanks and snap them in.

The overflow and drainage hoses from the developer and fixer should be guided into their respective collecting containers.

The overflow and the drainage of the water can either be guided into the drainage syphon or into respective collection containers.

3.5.3 Hose Connection

Hose Connections



3.6 Initial Operation

3.6.1 Test run



CAUTION!

Processor should not be run dry!

Upon commissioning and every refilling the pumps must be vented.

- 1 Close the three drainage stop cocks and fill the tanks and replenishment containers with water. Open water inflow tap. Connect electrical socket and switch the machine on. Water now flows into water tank. The circulation pump activates, however the hosing of the machine must be ventilated.
- 2 Ventilation of the replenishment pump: Set temperature dial to position „Manual pumping“. Keep dial to this position until no more air bubbles rise in the tanks.
- 3 Ventilation of the circulation pump: If air is in the circulation pump, a loud running noise can be heard. Switch the machine off again. Open the stop cocks of the developer and fixer for five seconds and then close them again. Then switch the machine on again. Repeat this procedure until no more air bubbles are visible in the developer and fixer baths and until the circulation pump runs quietly.
- 4 Check all hose connections for leakage. Switch machine off and drain water out.

3.6.2 Fill processor with chemicals

Prepare chemicals inside the replenishment containers according to manufacturer instructions.

3.6.2.1 Fill up processor manually

By using a suitable container, pour chemicals into the respective tanks. First the fixer and then the developer. Caution: when filling, be sure that chemicals do no splash from one bath into another. When fixer solution is mixed with developer solution, the developer chemical is destroyed.



CAUTION!

When filling by hand, do not pour chemicals into the slot of the lid switch and on the control panel. This can lead to damage of the parts.

Snap each suction pipe into the respective cover of its replenishment container and close it carefully. Place containers under processor.

3.6.2.2 Using replenishment pump

Filling of processor can also be done by use of the replenishment pump (this takes much more time). The chemicals containers need to be filled manually with at least 1.0 litres of fresh chemicals, to ensure the pumps will not run dry. Snap each suction pipe into the respective cover of its replenishment container and close it carefully. Place containers under processor. Now set the temperature adjusting knob to position "Manual pumping". Leave the knob in this position until the tanks have been filled. After 20 minutes this function stops automatically - to restart a cycle, turn dial to another position and return to „Manual pumping“. »Limitation: **Limitation:** The function may fill up tanks of developer and fixer to different levels. This may be due to different causes. If this happens, then use a suitable container to fill up the tanks completely.

4 Control elements and device displays

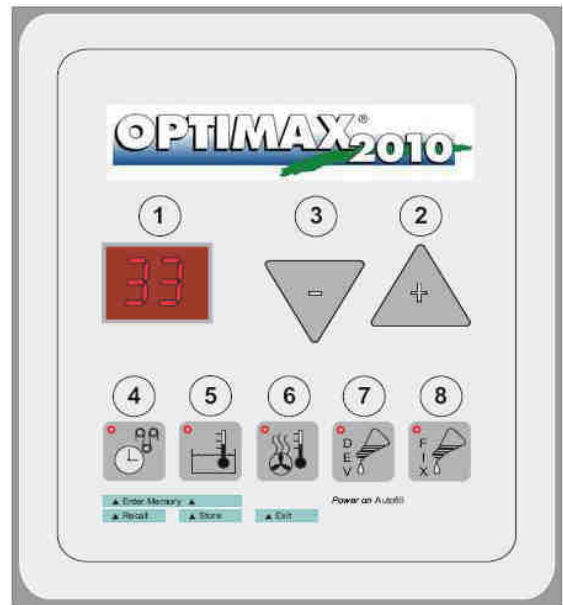
4.1.1 Control elements and device displays 2 pumps

Short Overview and Control Panel

- 1 Display working parameter
- 2 Arrow button „Up“ = increase parameter value
- 3 Arrow button „down“ = decrease parameter value

Mode Button

- 4 Processing time in minutes
- 5 Developer temperature in °C
- 6 Dryer output in %
- 7 Replenishment time developer in seconds
- 8 Replenishment time fixer in seconds



NOTE

Safety function stops film transportation when cover is removed.
Therefore keep cover placed on the machine when processing films.

5 Handling / Operation



CAUTION!

Upon first operation and each refilling of a developer check the function of the circulation pump and vent the pump if required (see 3.6.1 / 2)



CAUTION!

Never start the machine up unless it is filled with liquid!



CAUTION!

Do not place any object on the processor.



NOTE

High or low room temperature may influence the function of the film processor machine.



WARNING!

Hot air can escape when opening the light protection cover!
Surface film feed tray (sheet) can be hot!

5.1 Operation

5.1.1 Before use

- 1 Close water-drainage stop cock
- 2 Open water tap
- 3 Switch processor on
- 4 Check liquid level in replenishment and drainage collecting containers
- 5 Wait until the developer temperature is reached. If the temperature has not been reached, the bath temperature light is flashing
- 6 Run cleaning films through processor

5.1.2 Working procedure

- 7 Processing films:
Open light protection cover. Important: Put film first on *left* side of infeed tray and then feed in.
During processing films please watch the display „Infeeding film“.



NOTE

Put the film first on left side of infeed tray and then feed in.



CAUTION!

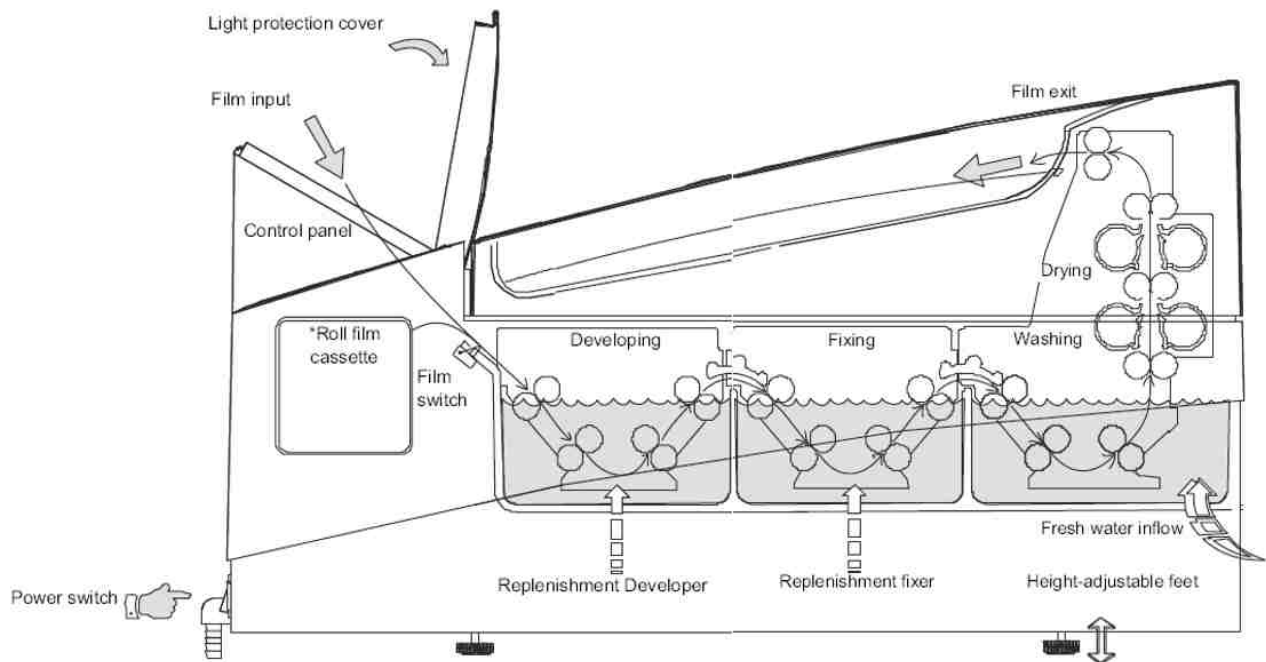
During processing films not the display „Infeeding film“

5.1.3 After work

- 8 Switch processor off
- 9 Close water tap
- 10 Open water-drainage stop cock and drain water out of the machine.

5.1.4 Stand-by mode

When no film is being processed, the machine switches to Stand-by. The chemicals remain at a constant temperature. The film transport and water inflow activate at intervals to avoid crystallization of the chemicals on the transport rollers. Entry of the next film is possible at any time.



5.2 Function of the automated X-ray film processor

5.2.1 Switching on the machine

Before switching the machine on, open the fresh water tap and close the water drainage tap (under control panel). Then switch the machine on (main switch is situated under the control panel). Once the machine is switched on, a "Start-cycle" of eight minutes duration is activated: A replenishment cycle is carried out, the water tank fills automatically and the chemical baths heat up. During this "Start-cycle" no films can be fed into the machine. The display shows two bars "--" when the processor is not ready and no films can be fed in. This is the case during the "start cycle" and also when the baths have not reached the temperature. Until the developer temperature is not reached, the developer temperature button (5) is flashing. It is possible that the chemical bath has not reached the required temperature even after the "Start-cycle" has been completed. You need to wait until the developer temperature is reached, before inserting films. Wait until the bars "--" disappear from the display.

5.2.2 Automatic mode

After completion of the "Start-cycle" and after a film-processing, the machine automatically goes into the stand-by mode. In the stand-by mode the processor can be started at any time by placing a film into infeed tray. Note that films can only be processed when the developer temperature is reached. When the display shows two bars "--" no films can be fed into the machine. The temperature in the bath is too high or too low. However, when a film was fed into the machine, two bars with decimal points "-.-". To avoid a jamming of films wait before feeding the next film in until this display disappears (which is also signalled by an acoustic sound).

A film in the feed-tray is registered by two film detection switches and the machine starts up. The film is pulled into the machine and transported through the developer, fixer and water baths. The remaining time of processing i.e. until the film finally leaves the machine is displayed, when no more film is in the infeed-tray and the processing time button was pressed. Each working-parameter can be called up on the display by pressing the respective mode-button, however, during processing, parameters cannot be altered. The temperatures of the developer and dryer are automatically regulated by the controller. The replenishment rate of developer and fixer chemicals is activated according to the processed film-surface (film-surface measurement). The dryer is heated to the set value. Inside the dryer, the film is dried and then normally output onto the cover. The machine then goes into the stand-by mode. To

keep the machine in working condition during the stand-by mode, the electronics have been furnished with two specialities: The anticrystallisation Function and the Time Replenishment.

5.2.3 Anti-crystallization function

During the stand-by mode, the film transport, the dryer ventilation, the dryer heating and the water inflow are activated every 20 minutes for a period of 20 seconds. This prevents the build-up of crystals on the rollers.

5.2.4 Time replenishment (Anti-oxidation function, Flood replenishment)

Also during the stand-by, the developer chemicals are subject to change which causes their deterioration. By means of the time replenishment, a replenishment cycle is activated after 60 minutes without replenishment. With this function, the quality of the developer chemicals are maintained even when standing idle for long periods. The time replenishment function can be deactivated.

5.2.4.1 Setting off the time replenishment

- 1 Switch the unit off.
- 2 Press the buttons processing time (4) and replenishment time (7) simultaneously and keep pressed.
- 3 Switch the machine on again and release the pressed buttons
- 4 Switch the time replenishment on or off with cursor keys (2 and 3). If you enter „0“ , time replenishment is off, „1“ switch it on
- 5 Switch the unit off to save the settings

5.2.5 Working parameters

The processing machine develops, fixes, rinses and dries the film materials automatically. The film and chemical requirements can be adjusted accordingly and stored in the control unit.

5.2.5.1 Display working parameters

- 1 Switch processor on
- 2 Press the respective mode button (4-7) and kept it pressed to display the set value

Press the respective mode button (4-7) and let it go to display the current actual value.

5.2.5.2 Setting working parameters

- 1 Switch processor on
- 2 Machine must be in the stand-by mode and no film must be in the processor
- 3 Press the respective mode button (4-7) and keep pressed: The display shows the set working parameter
- 4 Change the value by means of the arrow button (2 and 3) until required value appears on the display. The upward arrow button (2) increases and the down arrow button (3) decreases the value
- 5 Release the mode button

5.2.6 Processing time

The processing time, is the time, it takes the front end of a film from the infeed of the processor until it reaches the film exit. The processing time is set by the speed with which the film is transported through the machine. Depending on the requirements, this time can be varied from to 2.5 minutes (150 seconds) to 10 minutes, adjustable in 0.1 minute-steps (adjusting the processing time: see 5.2.5.2)

Processing and developer time relation		
Processing time (min)	Developer time (s)	Infeed speed (cm/min)
2.5	41	35
3.0	49	28
4.0	66	21
5.0	82	17
6.0	99	14
7.0	115	12

8.0	131	11
9.0	148	10
10.0	164	9

5.2.7 Developer temperature

The developer temperature of the different film-materials depends on the developing time. The faster a film has to be developed, the higher the temperature must be. The developer temperature can be set between 28-37 °C according to the individual requirements (Setting the developer temperature: see "Setting the working parameters:"5.2.5.2). If the temperature of the developer bath is lower or higher than the set value, then the developer temperature button (5) is flashing and the display shows two bars "--". Before feeding a film into the machine, wait until the temperature has been reached and the displayed bars "--" disappear.

The following chart shows guiding value relations between developer temperatures and processing times. Variations are possible depending on the various films and chemicals.

Processing time and developer temperature relation	
Total processing time (min(s))	Developer temperature (°C)
2,5 (150)	31 - 33
3,0 (180)	31 - 33
4,0 (240)	30 - 32
5,0 (300)	30 - 32
6,0 (360)	29 - 31
7,0 (420)	29 - 31
8,0 (480)	28 - 30
9,0 (540)	27 - 29
10,0 (600)	26 - 28

5.2.8 Dryer temperature

The dryer temperature cannot be set in degrees Celsius. However the dryer output can be set in a range between 10-99 % (100 %), to adapt it to the film material to be processed. "95" for example, corresponds to 95 % of the maximum output of the dryer heating. To avoid dryer spots on the film, the dryer output may not be set too high. Adjust the temperature so that the film just gets dry (Setting the dryer temperature: see "Working Parameters" 5.2.5.2).

Remark: Depending on mains voltage, dryer temperatures above 65 °C may under certain circumstances not be reached. The information in the table below are mere guiding values. Different combinations of film material, chemicals and ambient conditions may require different dryer output settings.

Processing time and dryer output	
Total processing time (min(s))	Dryer output (°C)
2,5 (150)	88 - 90
3,0 (180)	80 - 95
4,0 (240)	75 - 95
5,0 (300)	70 - 90
6,0 (360)	65 - 85
7,0 (420)	60 - 80
8,0 (480)	55 - 75
9,0 (540)	50 - 70
10,0 (600)	45 - 65



CAUTION!

High or low room temperature can influence the function of the film processor.

5.2.9 Replenishment time

The replenishment of the developer and fixer chemicals is automatic. By means of the film detection switches at the film-feed, the surface of the processed films is calculated and after 0.25 m² film a replenishment cycle is automatically activated. The replenishing volume can be set by means of the replenishment time. The replenishment time may be set in a range of 10-99 s. The replenishment can be switched off by entering "0". This is advisable in rare cases only.

The chart below shows the replenishment time to be set for the requested replenisher rate per m²-film surface. The standard setting is 40 sec. with 600 ml replenisher rate per m² film surface. The replenisher rate has to be adjusted depending on film material, chemicals and film throughput.

Relation of replenishment time and replenisher volume 2 pump version		
Replenisher volume (ml/m ²)	Replenishment time(s)	Replenishment rate (ml per cycle)
150	10	37,5
300	20	75
450	30	112,5
600	40	150
750	50	187,5
900	60	225
1050	70	262,5
1200	80	300
1350	90	337,5
1485	99	371,3



NOTE

Values for pump setting 100% supply volume or fort o 85% for 60Hz supply.

5.2.10 Machine cover Safety Disconnection

The machine cover may only be removed for service and maintenance purposes. The processor cannot be started without the cover. In the event that the machine cover is removed during film-throughput, the film transport will be stopped. On the display the error message "E1" will be displayed. This will render the film unsuitable. The error will be reset when the machine cover is reinstalled. Thereafter the motor may run a little faster for a short time.

5.2.11 Auto fill Function



In case new chemicals have to be filled into the processor (after installation, tank cleaning), the tanks can be filled automatically by means of the auto fill function. In the process, the tank is filled for a fixed period of 20 minutes, that is, chemicals are pumped from the replenishment containers to the tanks. Also the water bath will be filled (3 min. period). The display will show two symbolized tanks (see right). When the auto fill function has been completed, the machine enters the stand-by mode. If the respective baths are full before the time is up, the auto fill function can be stopped manually. The level switch in the developer bath detect a full bath and switches the pump off. The automatic tank filling can also be terminated manually.

5.2.11.1 Starting up the auto fill function

- 1 Switch the unit off
- 2 Press and hold the replenishment time button (7), switch the unit on

5.2.11.2 Manual cancellation of the auto fill function

- 3 Press and hold the replenishment time button (7) and press „arrow down“ button (3)

5.2.12 Manual Mode

In the manual mode, the processor works without the film detection switches. The film transport has to be started and stopped manually. All the set values in the manual mode are also valid in the automatic mode. Please note that the Infeeding-film display (“–”) is deactivated. Replenishment continues to operate based on detection of the film surface processed. Only if the film detection switches are activated, will film measurement be performed. In the manual mode, a replenishment cycle can also be activated manually.

5.2.12.1 Switching to manual mode:

Switch the machine on. During stand-by, press the arrow-buttons “up” (2) and “down” (3) simultaneously. When in manual mode the display is flashing.

5.2.12.2 Switching back to automatic mode:

In manual mode with film transport off press both arrow-buttons “up” (2) and “down” (3) simultaneously.

5.2.12.3 Manual starting and stopping the film transport

- 1 Switch to manual mode
- 2 Press the processing time button (4) – the button illuminates
- 3 Start the film transport by pressing the arrow-button “up” (2) or stop the film transport by pressing the arrow-button „down” (3)

5.2.12.4 Manual replenishment

- 1 Switch to manual mode
- 2 Press the replenishment time button (7) – the button illuminates
- 3 Start the replenishment cycle by pressing the arrow-button „up” (2) or cancel the replenishment cycle by pressing the arrow-button „down” (3)

5.2.13 Water Saving Mode

The water saving mode reduces the water consumption. If the water saving mode is activated, exactly 50 % less water is consumed.

5.2.13.1 Activating the water saving mode

- 1 Switch the unit off
- 2 Press and hold the buttons processing time (4) and dryer output (6) simultaneously
- 3 Switch the unit on again and release the pressed buttons
- 4 Switch the water saving mode off or on with the arrow buttons (2 and 3). If you enter “0”, the water saving mode is off, if you set „1” it is on
- 5 Switch the unit off to save the settings

5.2.13.2 Stop Film Transport

In a case of a film-jam inside interrupted. To stop the film simultaneously. Related topics:

see “Manual starting and stopping the film transport:” 5.2.12.3

see “Film is caught up in the racks”: 5.3.2.10

5.2.14 Use of Memory Function

In the memory two sets of parameters can be stored and be recalled to the operating memory.

5.2.14.1 Store processing parameters

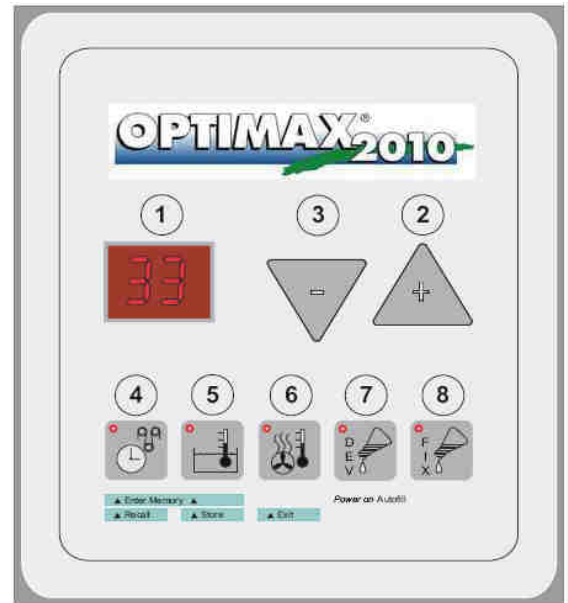
- 1 Set machine to preferable parameters e. g. bath temperature, processing time etc. (see manual)
- 2 Press buttons 4 and 5 „Enter Memory“ (simultaneously to enter the memory mode)
- 3 Use the buttons 2 and 3 „Select“ to select the parameter memory (P1 or P2). These save the parameters, old values will be overwritten
- 4 Press the button 5 „Store“ to store parameters and to leave the memory mode

5.2.14.2 Recall processing parameters

- 1 Press buttons 4 and 5 „Enter Memory“ simultaneously to enter memory mode
- 2 Use the buttons 2 and 3 „Select“ to select the parameter memory (P1 or P2) from which the parameters are to be recalled
- 3 Press button 4 „Recall“ to recall parameters (copy into the operating memory) and to leave the memory mode

5.2.14.3 To leave memory mode without change

- 1 Press button 6 „Exit“



Choose the same bath temperature for all stored programmes. Of course different bath temperatures can be stored too, but when changing the programme you always have to wait until the changed bath temperature is reached.

5.3 Problems and Solutions

5.3.1 Advice on Film Defects

Your processor has been constructed for long term use. If however irregularities might occur, you will find help to locate the problem below. Please check the listed points, before calling your service-technician.

5.3.1.1 Films do not have enough density

- Bath temperature is too low
- Developing time too short
- Exposure time is too short
- Replenishment rate of developer too low
- Developer chemicals are exhausted or too strong diluted: Renew
- Fixer solution has been mixed into developer: Renew. Clean and rinse bath well before refilling
- Circulation is broken down

5.3.1.2 Too high a density

- Bath temperature too high
- Developing time too long
- Exposure time is too long
- Replenishment rate of developer too high
- Developer chemicals are too high diluted: Renew
- After renewing chemicals: Starter is missing
- Circulation is broken down

5.3.1.3 Films will not dry

- If warm air comes out of the air channel in the dryer, chemicals and film type should be checked
- Fixer solution is exhausted or diluted

5.3.1.4 Film has a yellow-green surface

- Not fixed correctly. Check the film type and fixer chemistry
- Fixer solution is exhausted or diluted. Replenishment rate of fixer is too low

5.3.1.5 Scratches, pressure marks, dirt on film

- Prior to processing films, run cleaner films through the processor
- Pressure marks caused by careless handling, finger nails etc
- Rollers are polluted. Clean tanks and roller racks

5.3.1.6 Cloudy film

- Level in developer is too low
- First guide bar of fixer rack is dirty (condensate or crystals). Clean roller racks
- Developer is old or circulation not working
- Try processing films by infeeding them with emulsion side up

5.3.2 Advice on Machine Errors

5.3.2.1 Machine does not switch on

- Ensure that electrical plug is firmly inserted into socket. Ensure that electrical socket has power supply by testing with an appliance (e.g. table light)

5.3.2.2 Rinsing water does not flow

- Open water inflow tap
- Water pressure in the water system is too low: Minimum pressure 2 bar (29 psi)

5.3.2.3 Replenishment rate too high

- Check the programmed times of replenishment cycle and replenishment time

5.3.2.4 Replenishment rate too low

- Check the programmed times of replenishment cycle and replenishment time
- Check whether the machine can be started by means of each of the two film detection switches in the feed slot. If one of the film detection switches is defective, call your service technician. In the meantime, double the programmed replenishment time

5.3.2.5 Replenishment pump does not pump

- Check whether the replenishment containers are full and that the end of the suction pipe is positioned under the liquid level
- Check whether there is air in the replenishment pipes. Replenishment hose aspirates air. Check the hose connections

5.3.2.6 Water tank overflows

- Water drainage hose (overflow) is bent. The hose end should be positioned above the drainage level in the syphon
- Check water drainage in the tank and hose for blockage and pollution. The drainage hoses should have a constant fall

5.3.2.7 The film does not transport correctly

- Film is fed in and gets caught in the machine: Check the positioning of the racks in the machine and make sure that the latches are closed.

5.3.2.8 Film cannot be fed, the display shows „E1“

- Close machine cover securely, paying special attention that the switch on the rear of the control panel is actuated

5.3.2.9 Film is in the infeed and nothing happens

- Display is flashing: Control is in the manual mode. Switch back to Automatic mode (see 5.2.12.2).
- Insert the film into the film feed so it passes the film detection switches. Feed the film to activate one of the switches. If the unit should not start, activate the other switch. If the processor still does not start, call your service technician. In the meantime, with limitations the processor may be operated in the Manual Mode (see 5.2.12.1)

5.3.2.10 Film is caught up in the racks

- Switch machine off and remove cover
- Check in which rack the film is caught up in and remove the respective rack
- If possible, catch hold of the film end by hand and by manually turning the drive-shaft, pull the film out of the rack
- If a film is caught up in the machine due to a power cut, it can be transported out of the machine by activating the transport with a film in the infeed (machine can also be started up in the manual mode, see "Manual starting and stopping the film transport 5.2.12.3



CAUTION!

**Ensure correct seating of roller racks; keep the lock closed at all times.
Don't operate processor with empty replenishment tanks.
After a long machine shut down check bath level and refill if necessary.**

5.4 Error messages

Machine errors are shown on the display as abbreviations. The cause of error is explained below. For service technician: problem solution see "Trouble shooting" capture 7.

Display	Cause and possible correction
E1	Cover switch is not actuated. Place cover correctly on the machine and ensure that the cover switch behind the control panel is actuated. If the error cannot be corrected, then the cover switch may be broken.
UU	Too low level of the developer bath. Check the level and fill up by pumping manually or refilling manually

6 Safety and Maintenance



WARNING!

Caution Electrocutation hazard!

Prior to cleaning or disinfection, switch of the automated X-ray film processor. As a result, the processor will be disconnected from power and the danger of electric shock is eliminated.

6.1 Introduction

In this chapter, you will find details regarding safety and maintenance, which is required to ensure the correct and reliable function of the radiographic system following initial installation.

6.2 Cleaning and disinfection



NOTE

The colour changes in the baths is normal; it is caused by the properties of the chemicals!



CAUTION!

Do not use alcohol containing solvents to clean the machine!

Pay attention that, during cleaning and/ or disinfection, no fluids find their way into the main housing of the radiographic table. This reduces the risk of short circuits and corrosion.



CAUTION!

Do not let any liquid drop inside the processor or run over the control. Liquids may cause damage to the processor.

6.2.1 Cleaning

The cleaning of the automated X-ray film processor is very easy due to the very good surface coating. This is usually done only with a dry cloth.

Do not use corrosive, solvent or abrasive cleaning agents that can damage the surfaces of the device or the paint.

Clean the outer surfaces of the unit and all painted components using a damp towel and a mild – light alkaline cleaning agent (e.g. RBS* Neutral T). Dry the components off following cleaning.

6.2.2 Daily care

Before use

- Remove dirt and dust from film-infeed with soft cloth
- Run 2 - 3 cleaner films through processor to remove all accumulated dirt and dust from the rollers
- Check the liquid level in the replenishment containers and if necessary refill

After use

- When working has been completed at the end of the day, the water must be drained from the machine. This reduces the growth of algae in the water bath. For that purpose open the water drainage stop cock (see 3.5.3)

6.2.3 Weekly Care



CAUTION!

When removing the Rinsing / Drying roller-rack, ensure that no water gets into the film dryer air channel.

The developer chemicals cause residue build up in the machine. This residue has a negative effect on the developing process of the film material. For this reason the processor has to be regularly cleaned of this residues.

Do a weekly clean of the roller racks, which only takes a few minutes.

- 1 Switch machine off and remove cover.
- 2 Loosen the securing latches (red and beige) of the drive shafts of each roller rack at the right side.
- 3 Rinse all racks thoroughly under warm running water and then leave to drain off. Use a soft sponge (do not use scouring-pad, as this would scratch the rollers!) and remove the pollution from the rollers.
- 4 Wipe the infeed-roller-pair (first roller-pair of developer rack) dry
- 5 Replace the racks: Red = Developer, Blue = Fixer. Beige = Washing/Drying. Ensure that the racks are firmly installed and do not forget to close the securing latches on the drive shafts.
- 6 Replace machine cover and ensure it is securely closed.
- 7 Clean processor outer shell with damp cloth. Do not use aggressive cleaners or solvents.

6.2.4 Thorough Cleaning

Every 3 – 6 months a thorough cleaning is necessary, depending on the quantity of films processed. Tank cleaners are available for developer and water baths. The fixer bath is cleaned with water. When preparing chemical tank cleaners, follow manufacturer instructions explicitly.

How to proceed:

- Switch the machine off and empty all tanks by opening the stop cocks. Attention: Machine will not drain off, if it is switched on
- Remove machine cover. When all tanks are emptied, close stop cocks again. Now fill the fixer-tank with water. Prepare cleaner solutions for developer and water baths and fill into respective tanks
- Remove suction pipes from the replenishment containers and place them in a water filled bucket. Attention: Do not add chemical cleaners here!
- Close machine cover and switch machine on
- Start film transportation and keep running for 10 to 20 minutes. During this the installed roller racks will be cleaned



NOTE

After completion of tank cleaning, the tank should be rinsed thoroughly with clean water. To do this, fill the machine with fresh water twice and each time, let the machine run for a 10 minute period. Empty the tanks and reclose the stop cocks.

- Take out the roller-racks and rinse them thoroughly with running water. Remove remaining dirt from the rollers by using a sponge and clean thoroughly. Doing this, the rollers can be turned by turning the drive shaft. Remove the sheet metal covers from the dryer rack and clean the rack with soap (dishwashing liquid). Reinstall the roller-racks in the machine.
- Refill the tanks with respective chemicals. Replace the suction pipes into the replenishment containers. In certain circumstances the circulation system must be ventilated: see 3.6.1 / 2
- For quality check, process test films.

6.2.5 Before you go on holiday or longer than 2 weeks not use

If the automated X-ray film processor will not be in use for longer than two weeks, all the chemicals have to be emptied out of the tanks. In case you don't want to do a complete tank cleaning at once, then fill the tanks after emptying, with water.

6.3 Check-up and maintenance



WARNING!

It's forbidden to make any check-up or maintenance services while the automated X-ray film processor is in use with a patient! Any check-up or maintenance services can only be done by people who got trained or authorized by PROTEC.



CAUTION!

Never start the machine up unless it is filled with liquid!

6.3.1 Recommended Maintenance Work

- 1 Functional check
film intake / film transport / replenishment / bath heating / dryer heating / water supply
- 2 Cleaning
 - 2.1 Switch off machine, remove cover
 - 2.2 Empty all three tanks
 - 2.3 Close drain cocks and fill tanks with water
 - 2.4 Install cover, switch machine on
 - 2.5 Fill two additional vessels with water, put suction pipes into these vessels and activate replenishment for at least two minutes (to remove residues of chemicals from replenishing hoses)
 - 2.6 Switch machine on for a few minutes
 - 2.7 Switch machine off
 - 2.8 Empty all tanks
 - 2.9 Prepare tank cleaning agent for developer and water tank according to manufacturer instructions



CAUTION!

Do not use chlorine containing cleaning agents.

- 2.10 Fill developer and water tank with tank cleaning agent (**do not use the replenishment pump to do so**)
- 2.11 Fill fixer tank with water
- 2.12 Place suction pipes into empty tanks
- 2.13 Install cover, switch machine on
- 2.14 Wait until the operating temperature is reached, approx. 30 °C (observe information concerning temperature, time, cleaning procedure contained in the datasheet of the tank cleaning agent)
- 2.15 Activate the transport (activate film intake switch)
- 2.16 After approx. 15 minutes (observe information concerning temperature, time, cleaning procedure contained in the datasheet of the tank cleaning agent) switch film transport off
- 2.17 Remove cover, neutralise developer tank (observe information concerning temperature, time, cleaning procedure contained in the datasheet of the tank cleaning agent)
- 2.18 Switch machine off
- 2.19 Empty all three tanks
- 2.20 Fill machine with water and switch it on
- 2.21 Put suction pipes into vessels with water

- 2.22 Activate regeneration pumps for at least five minutes
 - 2.23 Check all pumps for tightness
 - 2.24 Switch machine off
 - 2.25 Drain tanks
 - 2.26 Fill tanks 3/4 with water
 - 2.27 Switch machine on
 - 2.28 Activate replenishment pumps manually until tanks overflow
 - 2.29 Activate film transport for a few minutes
 - 2.30 Switch machine off and drain all three tanks
 - 2.31 Repeat item 2.20 to 2.30 if required (observe information e. g. concerning temperature, time and cleaning procedure outlined in tank cleaner datasheet)
 - 2.32 Remove roller racks from the machine and remove dirt under flowing water using a soft rag or sponge
 - 2.33 Clean all toothed gear wheels, axles, bearings and rollers, check them for damage (replace if required)
 - 2.34 Remove light protection flap and wipe its underside using a soft rag
 - 2.35 Clean inlet plate using a soft rag
 - 2.36 Mount the cover sheet of the film intake
 - 2.37 Align roller racks and re-insert them in machine
 - 2.38 Fill machine with chemicals
 - 2.39 Switch machine on
 - 2.40 Adjust bath temperature to previously adjusted value
 - 2.41 Feed cleaning film (approx. 4 pieces)
 - 2.42 Check function as described under item 1.
 - 2.43 Approx. 15 minutes after reaching of the bath temperature, check it by measuring and recalibrate if required (see 7.4.5)
- 3 Perform constancy tests based on the applicable national standards (e.g. IEC61223-2-1 and DIN 6868-2).

6.3.2 Maintenance

Required maintenance must be performed at 3-6 month intervals, depending on the film throughput, by PROTEC Service or specific authorized service provider to ensure the safe and reliable operation of the equipment.

In the event that scheduled maintenance is not performed, PROTEC X-ray Systems GmbH will not be responsible for damages incurred by the user or third parties if such damages are the result of improper or omitted maintenance.

Prior to operation, the operator must ensure that all Safety related mechanisms, indicators and/or switches described within the user manual are fully functional and that the unit is overall operationally ready.

See Technical Description of the system and of all integral components.

Only original spare parts are to be used in situations requiring component replacement.

6.3.3 Maintenance Protocol

Installation

Name:	Machine type:	Serial number:
Technician:	Training:	by:
Telephone:	Date:	Guarantee until:

Parameters Set

Developer temp:	Dryer temp:	Cycle time:
Dev.reg. volume:	Dev.reg. volume:	Anti oxidation:
Changed by:	Date:	Film type:

Developer temp:	Dryer temp:	Cycle time:
Dev.reg. volume:	Dev.reg. volume:	Anti oxidation:
Changed by:	Date:	Film type:

Developer temp:	Dryer temp:	Cycle time:
Dev.reg. volume:	Dev.reg. volume:	Anti oxidation:
Changed by:	Date:	Film type:

Maintenance work performed

Maintenance work performed	Maintenance work performed	Maintenance work performed	Maintenance work performed
Date	Date	Date	Date
Name	Name	Name	Name
Next maintenance:	Next maintenance:	Next maintenance:	Next maintenance:
Maintenance work performed	Maintenance work performed	Maintenance work performed	Maintenance work performed
Date	Date	Date	Date
Name	Name	Name	Name
Next maintenance:	Next maintenance:	Next maintenance:	Next maintenance:
Maintenance work performed	Maintenance work performed	Maintenance work performed	Maintenance work performed
Date	Date	Date	Date
Name	Name	Name	Name
Next maintenance:	Next maintenance:	Next maintenance:	Next maintenance:

6.4 Warranty



NOTE

The current conditions of guarantee are deposited in the order papers or in the valid pricelist to the time of purchase.

All repairs and replacement of components because of misuse and/or incorrect operation are excluded from the warranty.

Only authorized technicians may do service and maintenance work.

6.5 Product life time

The automated X-ray film processor has an expected product life of 7 years when used in accordance with the product specifications/ limitations and provided that maintenance through the PROTEC service department or a **PROTEC** authorized service provider has be completed. After reaching the life span the further usage of the device happens on own risk.

6.6 Further Information

Further information's to the chapters and for a safe usage, transport or storage are in this user manual.

6.7 Disposal



Used machine contain value able materials that should be recycled and turned over for proper treatment. Please be sure to turn used machines over to approved recycling centers.

7 Trouble Shooting

7.1 Algae

7.1.1 Excessive algae growth in water tank

Algae growth inside the water tank is not only annoying, it causes increased cleaning work and leaves residue on the films. When algae growth increases, countermeasures are in demand:

- When work has been completed at the end of the day, drain water out of the machine
- Clean dryer-water rack regularly. Use soft sponge and soap to remove residue from the rollers
- Install a particle filter system in the fresh water supply for the processor
- If water tank overflows due to algae growth blocking the overflow hose, then the overflow hose can directly be connected to the connection at the water tank inside the machine
- If no other solutions can be found, then usage of Anti-Algae-Agents can be a great improvement (automatic dispensers work the best). However, it is known that cleaning agents containing chlorine may corrode rubber rollers and high-grade steel in the tank area (check before use)

7.2 General

7.2.1 Unit does not switch on

- Ensure that electrical socket has power supply
- Check machine fuse in main switch
- While power switch is on, check the following components: Voltage on contact of main switch
- If there is no voltage: - change main switch. Check input voltage at electronics. If the voltage is normal, replace the electronics. If there is no voltage: check the cable



CAUTION!

For replacement exclusively use PROTEC gold cap fuses. These fuses are optimized for use under existing conditions.

7.2.2 No display but circulation pumps run

- Check input voltage of 5 V at the contacts no. 1 and 8 of the 8-pole-plug X18 from the control panel PCB. If voltage is present, then replace the control panel
- Disconnected the temperature sensor of the developer bath (X15) and check again.

7.3 Drive

7.3.1 Film transport does not run, film processing has started

- Display "E1": see "Error messages" see 5.4
- Check screwing of chain wheel on motor- and driveshaft.

7.3.2 Machine does not start automatically

- When the machine is switched on, insert a film into the feed. If the display shows two bars with decimal points, then at least one of the film detection switches is in order. Check the function of both switches, replace as needed
- The display shows "E1": The cover switch is not actuated by the latch on the cover. Cover switch has no current passage when activated: Replace

7.3.3 Machine doesn't stop automatically

- Display is flashing: Control is in the manual mode. Switch back to Automatic Mode (see 5.2.12.2)
- The display continuously shows two bars with decimal points: Actuator of the film detection switch is jammed. Readjust the switch or replace it. If the switches are defective, the machine can still be used in the manual mode (see 5.2.12.1)
- The power output section may be defective, if so replace it

7.3.4 Drive motor does not run

- Display "E1": see "Error messages" see 5.4
- No continuity of cover switch when activated: Replace
- Check drive motor: If voltage can be detected on motor, then motor is defective

7.4 Baths

7.4.1 No circulation in bath

- Circulation pump works but no circulation in bath: Air lock in heating and circulation system. Ventilate pump
- Particles in the pump chamber. The pump chamber can be easily opened by removing the four clips. When closing again ensure that the rubber seal is positioned correctly and not damaged
- Check connection of pump, circulation pump possibly defective.

7.4.2 Developer temperature to high

- Check attachment of temperature sensor. This should be firmly positioned on tube and completely covered with foam rubber.
- Check sensor: Check voltage between pin 3 (green) and pin 2 (brown). At room temperature the tension must reach approx. 0.3 V
- If the sensor has no fault then electronic is defective.

7.4.3 Developer temperature to low

- Check circulation pump. Air lock in the circulation pump: Ventilate pump (3.6.1 / 3). If no circulation can be detected: Check wiring of circulation pump, pump possibly defective
- Bath is not heated: Check temperature safety switch on heat-exchanger. Check heating element: impedance across the element should reach approx. 66 W
- Check temperature sensor (see 7.4.2)
- If no error can be found then electronic is possibly defective.

7.4.4 Developer temperature too low, fixer temperature too high

- Air lock in the circulation pump: Ventilate circulation (see 3.6.1 **Fehler! Verweisquelle konnte nicht gefunden werden.** / 3)

7.4.5 Developer bath temperature too high or too low (display shows values of 21 °C or 40 °C)

- Check temperature sensor. Sensor is either not connected or defective

7.4.6 Switch-over °C to °F

The developer temperature can be displayed in either °C or °F.

Switch-over of temperature unit:

- 1 Switch the unit off
- 2 Press and hold the buttons processing time (4) and developer temperature (5) while switching the unit on
- 3 Select the desired unit of measure with the arrow keys (2 and 3). C for Celsius and F for Fahrenheit
- 4 Switch the unit off to save the unit displayed

7.4.7 Calibration of bath temperature / actual bath temperature is different from displayed value

Differences between displayed temperature and measured value in the developer bath can be adjusted. An adjustment may be necessary after replacement of a bath temperature sensor. An adjustment is recommended when the deviation exceeds ± 0.5 °C and is mandatory if the deviation exceeds $\pm 1,5$ °C.

Calibration process:

- 1 Switch the unit off. Press and hold the developer temperature button (5) and switch the unit on. The display indicates the developer temperature measured by the sensor in 1 degree increments
- 2 Measure the actual temperature inside the developer bath using a calibrated thermometer
- 3 Adjust the displayed value in 1-degree-steps to the thermometer value, using the arrow buttons (2 and 3). Display of the digit after the decimal point is activated by pressing the developer temperature button (5). Adapt the value after the decimal point to the thermometer value, using the arrow buttons
- 4 Switch the unit off to save the calibration

7.4.8 Developer level switch constantly displays "UU"

- Observe notes under 5.3.2.5 "Replenishment pump does not work or works insufficiently"
- The developer level switch is not positioned correctly. The switching point is below the developer overflow. Readjust the height of the level switch
- The level switch is defective (e.g. closed permanently)
- If all of the above points are okay, replace the control unit

7.5 Film defects

7.5.1 Films will not dry

- Check the set dryer output ("99" corresponds to maximum, that is full heating output)
- No air comes out of air channel: check the connections of the fan, e. g. fan defective
- Cold air comes out of air channel: check the connections of the heating element in the air channel, the heating element may be defective (resistance must reach approx. 45Ω)
- Hot air comes out of air channel, but the film is still not dried to satisfaction. Check chemicals and film type. If this leads to no solution, then the transport speed of the machine can be reduced

7.5.2 The film does not transport correctly

- Check the positioning of the racks in the machine and make sure that the latches are closed
- Check the roller racks: Position of the guide elements, rollers are in correct position and are not loose, flat springs are not bent, all gears are in place
- Motor runs: The worm gear of the drive shaft should be secured with a splint to avoid twisting. Check the screws and positioning of the chain and chain wheel

7.5.3 Scratches, pressure marks, dirt on film

- Straight scratches in the infeed direction indicate faulty guide elements. Check each rack and straighten up the guide elements. If mechanically damaged, replace the guide elements
- Pressure marks caused due to polluted or damaged rollers. Check rollers for visible damage. Rubber rollers sometimes swell up. Exchange defective rollers

7.6 Replenishment

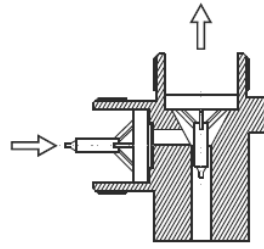
7.6.1 Replenishment pump does not work or works insufficiently

- Check the switch position on the pump
- Clean valves inside connection tube of pump



CAUTION!

Install valve-insert correctly: Pay attention to flow-through direction!



- Check filter in the suction pipe (repl. container) and clean it if necessary
- Replenishment hose aspirates air. Check connections
- Check eccentric position. Flow rate is 240 ml/min at maximum eccentric position 100% (60 Hz: 240 ml/min at 85 %!)
- Measure the voltage at the connection X6 (replenishment pump) on the power output section while the replenishment is switched on (in manual mode). If no voltage can be registered - replace the power section PCB. Remark: 2 pump version: developer replenishment pump at X6 and fixer replenishment pump at X5

7.7 Dryer

7.7.1 Dryer fan does not run or runs with too low speed

- Check the correct connecting of the fan cables: *bl* = blue; *bk* = black; *br* = brown
- If the fan supply lines have been transposed, the dryer fan will run at half the nominal output only

7.8 Water

7.8.1 Rinsing water does not flow

- The water pressure in the water supply system is too low: Minimum pressure 2 bar (29 psi)
- The valve opens, but no water flows through: filter at inflow is blocked
- Check the green water inlet hose inside the machine
- The water level switch is not positioned correctly: switching point is too low (below the overflow level), therefore no fresh water is supplied
- The level switch is defective (e. g. permanently open)
- Start the unit in manual mode and measure the voltage at the connection X4. If no voltage can be registered, replace the power output section PCB

7.8.2 Water tank overflows

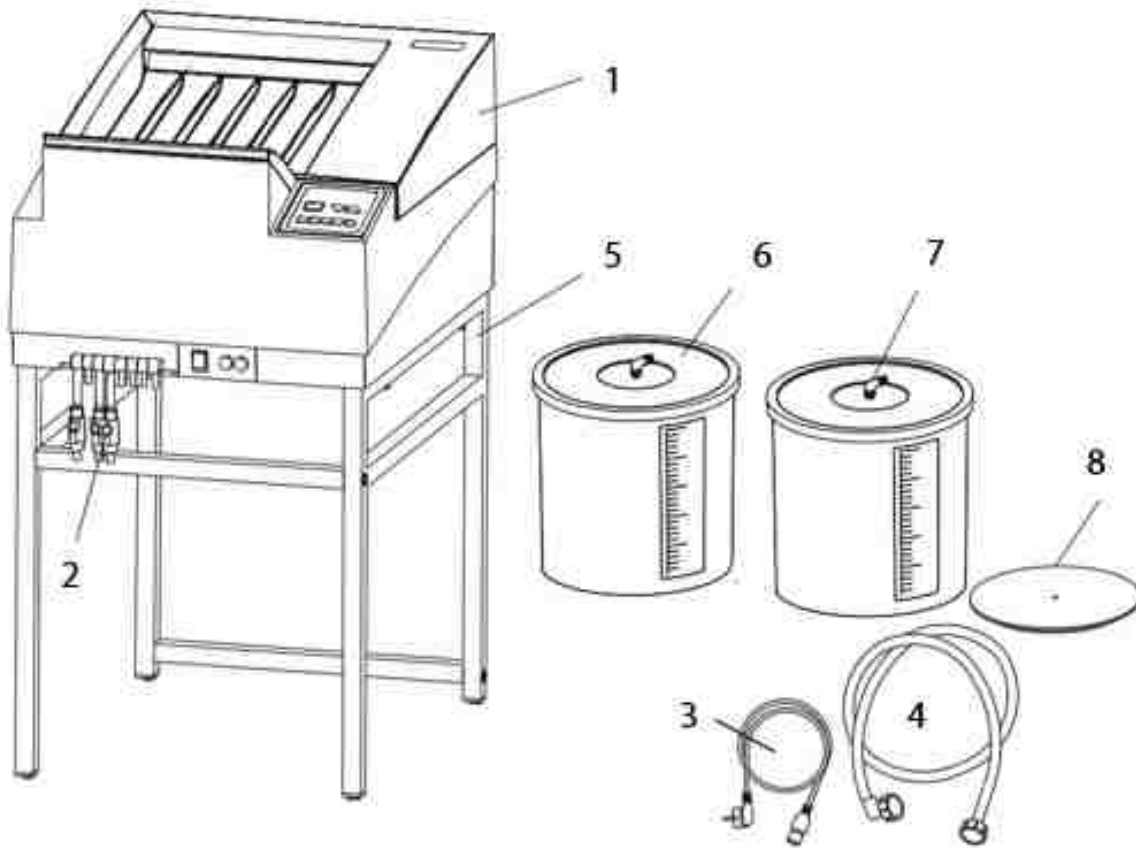
- Water drainage hose (overflow) should have a constant fall. The hose end should be positioned above the drainage level in the syphon
- Check water drain opening in the tank and the hose for blockage and residues
- When extreme algae growth is noticed, the overflow can be connected directly at the back of the water tank

7.8.3 Rinsing water constantly switches on and off

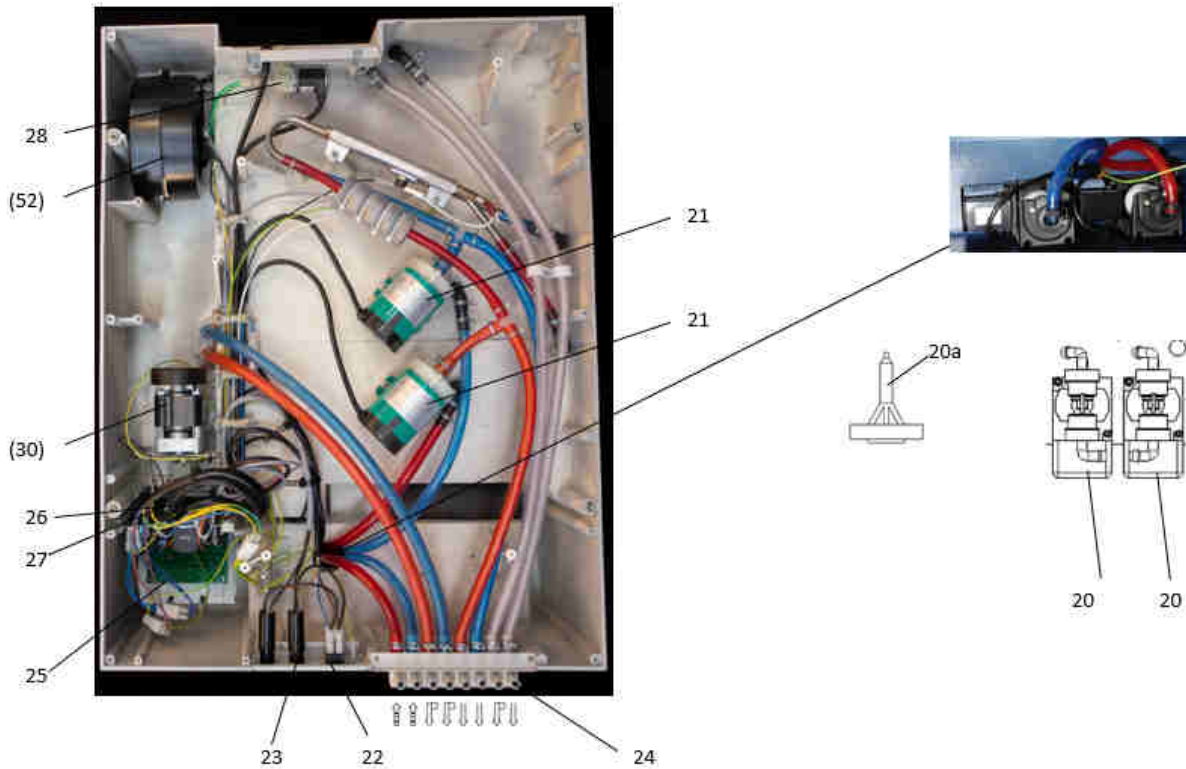
- At regular intervals (approx. 1 minute on and 1 minute off): The water saving mode has been activated
- At short intervals: The level switch is not positioned correctly (exactly on the overflow level). Insert the rack. If the error continues to occur, readjust the height of the level switch

8 Spare Parts and schematics

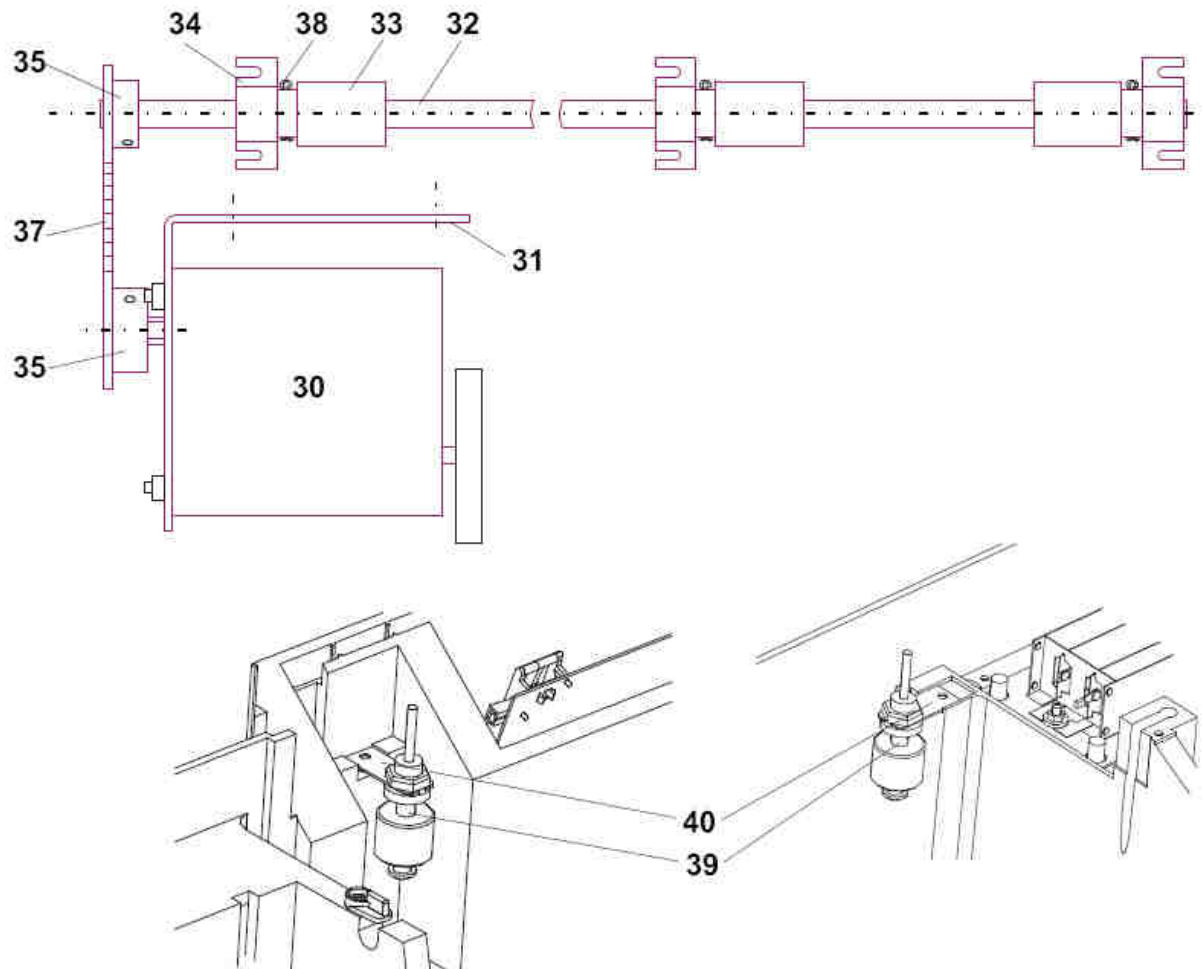
8.1 Spare Parts



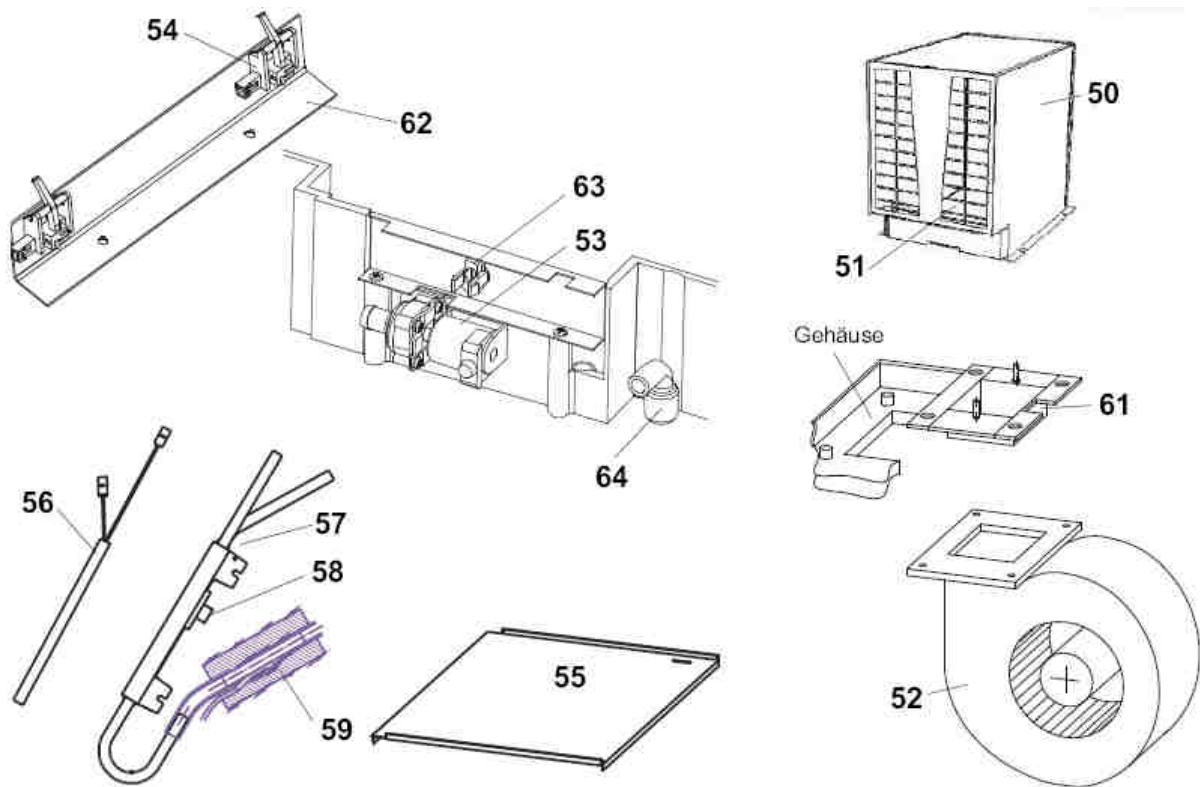
Pos.	Order No.	Description
1	1160-0-0280	Cover complete
2	2006-0-0005	Drain stop cock 10 mm
3	2004-0-0010	Electrical power lead 220-240V
4	2018-0-0001	Water inlet tube
5	1267-0-0000	Processor stand
6	1101-0-2000	Replenishment tank 25l E
	1101-0-2100	Replenishment tank 25l F
7	1101-0-1700	Intake manifold w. Filter for 25l tank
8	1101-0-4100	Floating cover developer
-	2018-0-0012	Hose 10 x 2 mm, clear, reinforced
-	2018-0-0009	Hose 10 x 2 mm, blue, reinforced
-	2018-0-0008	Hose 10 x 2 mm, red, reinforced
-	2018-0-0005	Hose 4 x 1 mm, green
-	2018-0-0021	Hose 9 x 2 mm, red, clear
-	2018-0-0022	Hose 9 x 2 mm, blue, clear
-	2022-0-0014	Tube clamp Snap
-	2022-0-0019	Wire tube clamp
-	2022-0-0026	Wire tube clamp
-	2022-0-0028	Wire tube clamp
-	1101-0-4600	Floating balls, 300 pcs.
-	1101-0-4800	Floating balls, 200 pcs.



Pos.	Order No.	Description
20	1160-0-2460	Replenishment pump 200ml/min.
20a	0002-5-0019	Cone valve for Pos. 20 and 20b
21	0202-5-0022	Circulation pump 5,5l/min.
22	2028-0-0023	Main switch 220-240V
23	2010-0-0004	Fuse holder
-	2010-0-0010	Fusible, gold T 10A/250V
-	2007-0-0004	Cover for fuse holder
24	1170-0-0702	Angle connection
25	0163-5-1300	Control unit 230V
	1160-0-0001	Eprom for 2 pump version
26	0170-0-2400	Micro switch with operator (cover)
27	2007-0-0010	Operator for micro switch
28	2021-0-0001	Screw in connector

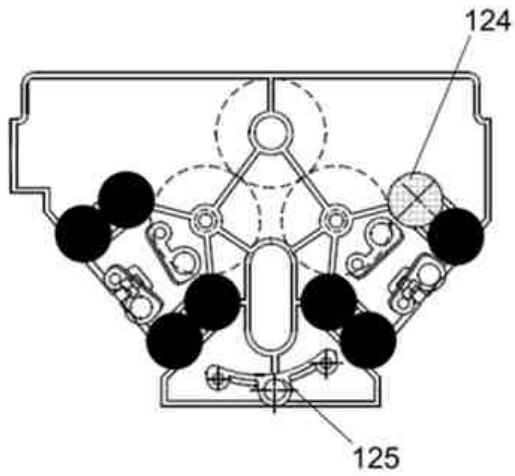


Pos.	Order No.	Description
30	1160-9-1185	Main drive motor
31	1170-0-1121	Motor bracket
32	1170-0-1501	Drive shaft worm gear
33	1170-0-1503	Worm gear
34	1170-0-1502	Supporting bock
35	1170-0-1506	Chain wheel t=12
	1170-0-1504	Chain wheel t =14
	1170-0-1505	Chain wheel t =16
	1170-0-1102	Chain wheel t =17
	1170-0-1507	Chain wheel t =18
37	2037-0-0002	Chain 6mm with coupler link
38	3000-9-4013	Splint 2,0x20 mm
39	2012-0-0013	Level switch
40	1120-0-1502	Bracket for level switch

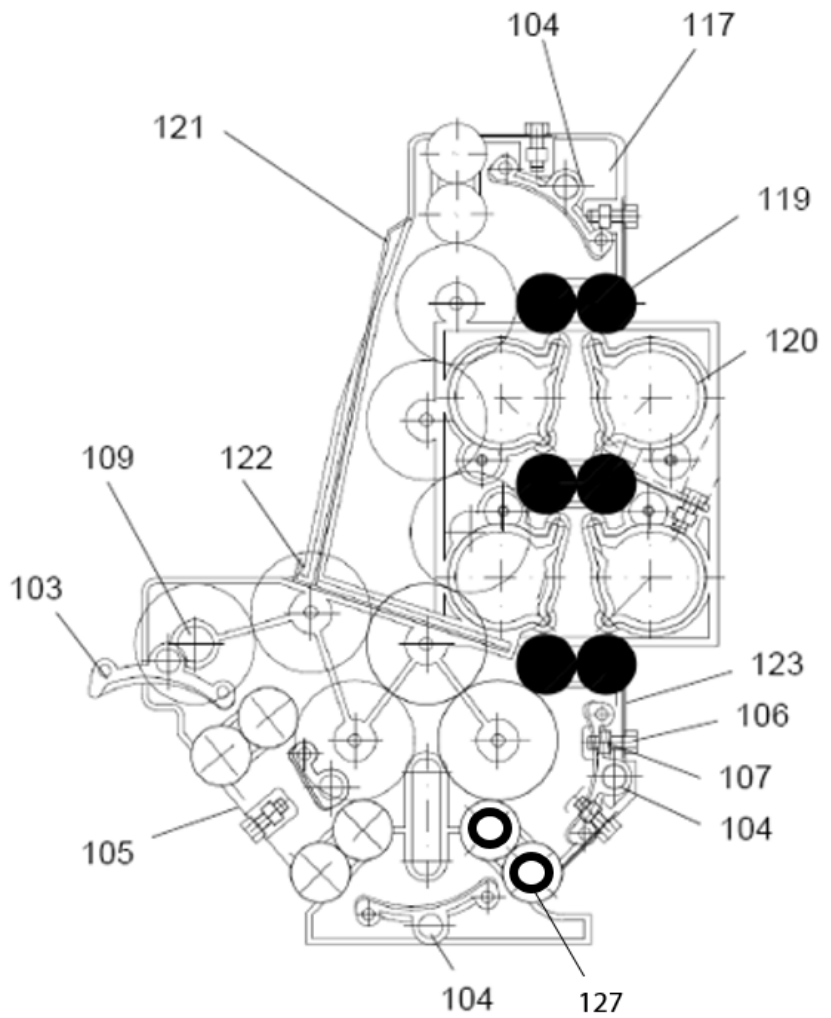
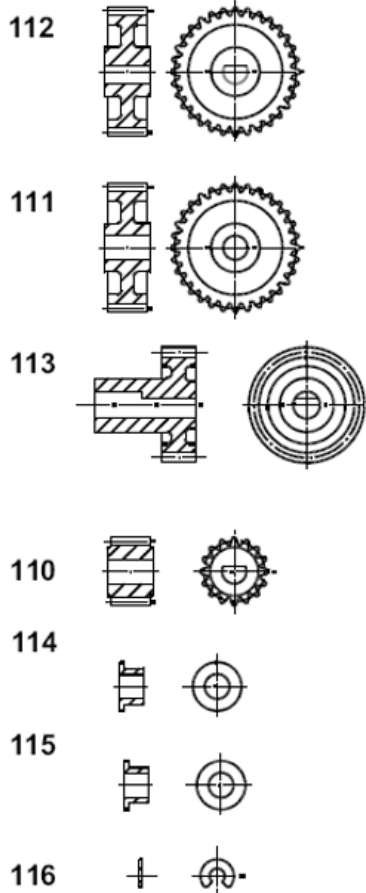
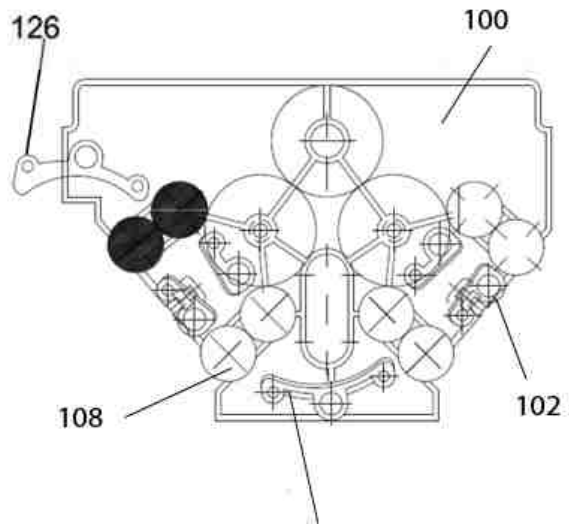


Pos.	Order No.	Description
50	1170-0-1301	Air channel
51	0170-0-1300	Heating element 230V, 1100W
52	2008-5-0007	Dryer van 220-240V, 50/60Hz
53	1160-5-1900	Solenoid valve 220-240V, 50/60Hz
54	2007-0-0015	Micro-rotary-switch for film-detection with operator
55	1160-0-0105	Film feed tray
56	2003-5-0002	Cartridge heater 230V, 800W
	2003-5-0012	Cartridge heater 230V, 400W
57	1130-0-2101	Heat exchanger
58	2005-0-0005	Temperature safety switch mounted on heat exchanger
59	0190-0-2200	Temperature sensor
61	1170-0-1302	Channel dryer heating
62	1160-0-0801	Bracket for micro-rotary-switch OPTIMAX
63	2027-0-0021	Strain relief
64	1160-0-0710	Hose nozzle rubber

Developer (red)



Fixer (blue)

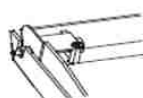
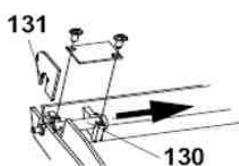


Pos.	Order No.	Description
-	1163-0-0300	Roller rack, developer NDT
-	1163-0-0400	Roller rack, fixer NDT
-	1163-0-0600	Roller rack, dryer NDT
100	0170-0-0301	Side plate developer with shafts (left)
	1170-0-0301	Side plate developer (right)
	0170-0-0401	Side plate fixer with shafts (left)
	1170-0-0401	Side plate fixer (right)
102	1140-0-3800	Guide bar straight, short
103	1140-0-4500	Guide bar with nose
104	1140-0-3700	Guide bar, curved
105	1170-0-0304	Flat spring 55
106	3079-8-5013	Screw M4x10, A4
107	3009-3-4023	Hexagonal nut M4, A4
108	1140-0-0301	PU-roller 35 ground
109	1170-0-0310	Driver shaft Rack
110	1101-0-0302	Chain gear t = 16 D-hole
111	1101-0-0304	Chain gear t = 32 round hole
112	1101-0-0303	Chain gear t = 32 D-hole
113	1170-0-0302	Worm gear
114	1101-0-0305	Bushing without clearance
115	1101-0-0317	Bushing big, black
116	2014-0-0001	Circlip
117	0170-0-0601	Side plate dryer with shafts (left)
	1170-0-0602	Side plate dryer (right)
119	1140-0-0302	Rubber roller 35
120	1140-0-0605	Air jet (35)
121	1170-0-0604	Dryer plate, large
122	1170-0-0603	Dryer plate, small
123	1170-0-0303	Flat spring 35
124	1163-0-0307	Roller NDT
125	1161-0-3900	Guide bar 2, curved without nose, without ribs
126	1161-0-4000	Guide bar 2, curved with nose, without ribs
127	1101-0-0317	Bearing bush, large , black

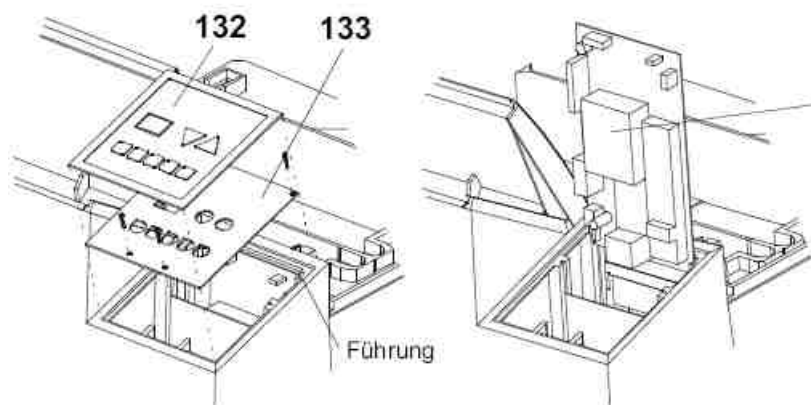


CAUTION!

To maintain constantly good film quality the NDT-roller (upper roller of first roller pair of fixer rack) has to be changed every 3 - 6 months, depending on the quantity of films processed, the chemicals and films used. These rollers must be considered wear parts and are excluded from the guarantee.



The light protection cover can be removed. This is necessary to gain access to the film detection switches and the developer level switch. To remove it, pull off the blind (131) on the right side (!) of the cover and the pull the indexing bolt (130) from the support toward the inside. The cover can now be removed to the top. Remark: The left indexing bolt remains completely installed.



Once the operating panel PCB has been removed, the control unit can be removed. Please do not lift the control unit out further than shown in the illustration. A guide on the top edge allows to position the control unit for service purposes.



WARNING!

The heat sink is not earthed

Pos.	Order No.	Description
130	1160-0-3103	Indexing bolt
131	1160-0-3106	Blind for light protection cover
132	2011-0-0137	Control panel foil
	2011-0-0139	Control panel foil, 2 pump version
133	0160-9-1200	Control panel

8.2 Tips and Tricks

8.2.1 Removal of control PCB

To reach the screws of the control PCB, remove the film covering the buttons by approx. 20 mm on the top and bottom edges (lift it, see illustration top left).

8.2.2 Stop start-cycle

The start-cycle (after switching the machine on) can be manually interrupted. To stop start-cycle, press both arrow-buttons (2+3) simultaneously. The start-cycle may only be interrupted for service purposes.

8.2.3 Display of machine information

When during the start-up cycle one of the arrow-buttons is pressed then various machine information will be displayed.

8.2.3.1 Arrow button "Up":

The software version is displayed as long as you press the button.

8.2.3.2 Arrow button "Down":

The number of film cycles is displayed as long as you press the button. Not the decimal point. Since the display has two digits only, the value needs to be converted:

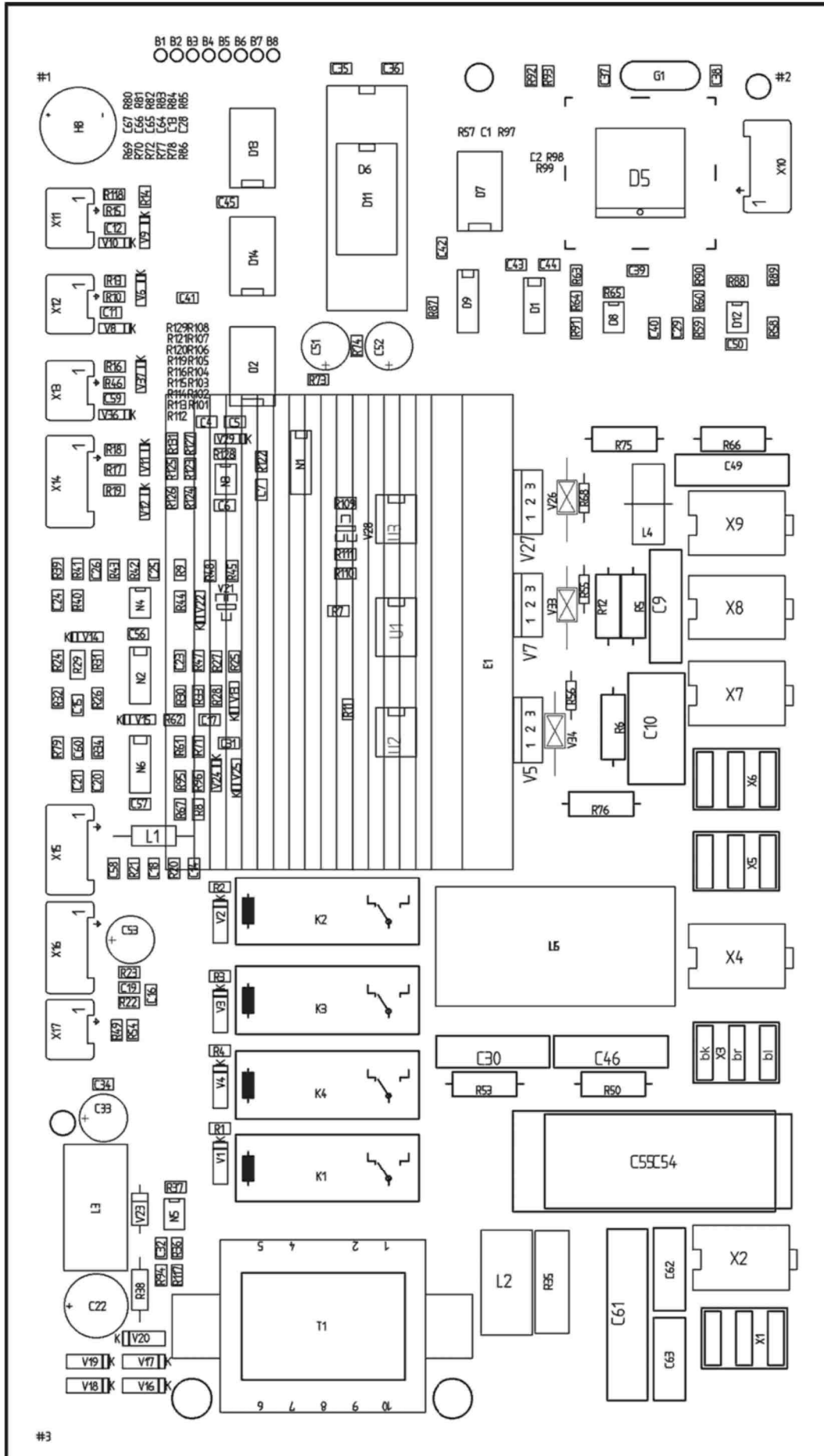
XX : value x 10 = number of films

XX. : value x 100 = number of films

X.X : value x 1,000 = number of films

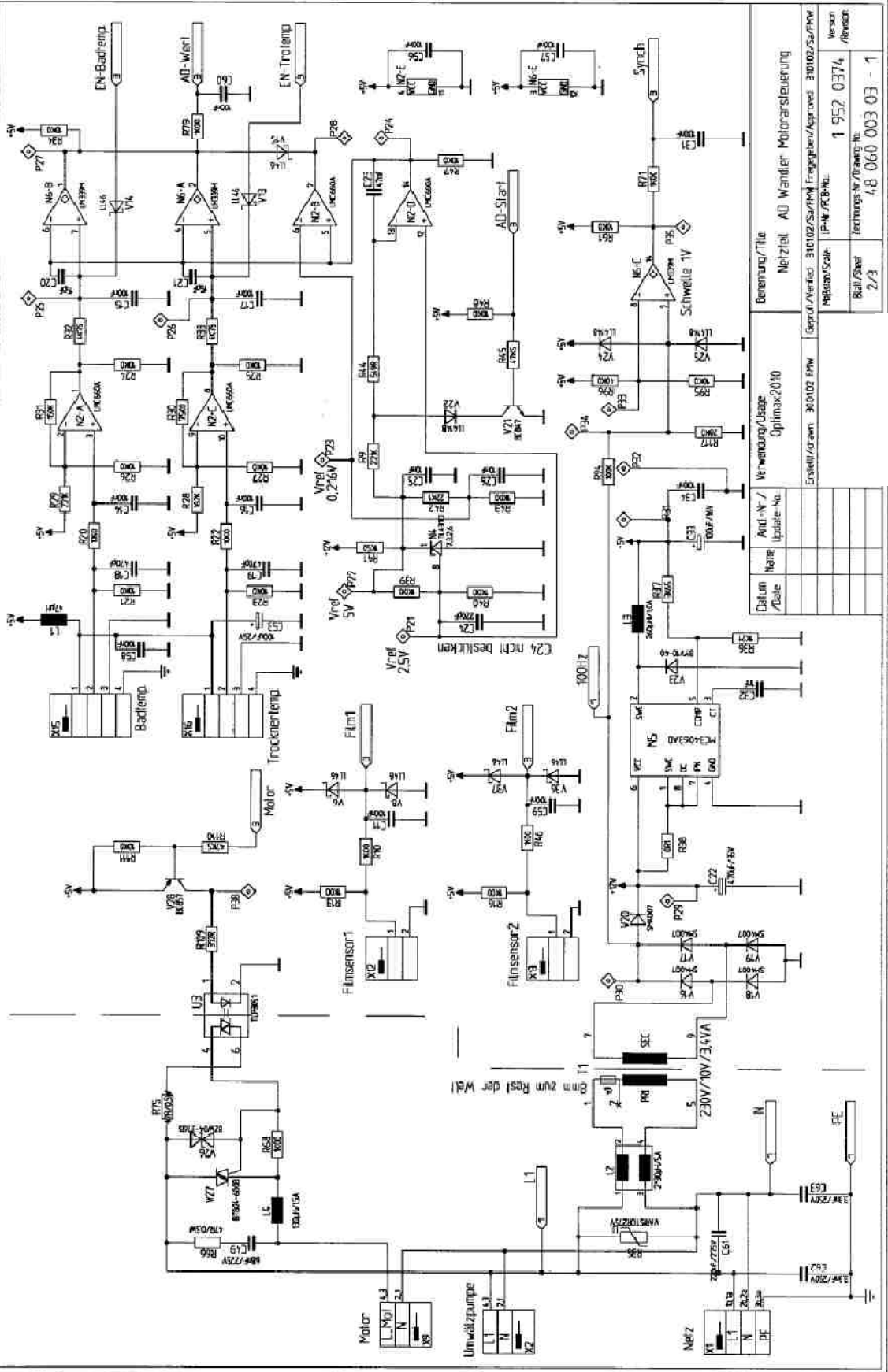
X.X. :value x 10,000= number of films

9.9. : more than 990,000 films



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Benennung/Titel		Netzteil AD Wandler Motoransteuerung	
Verwendung/Usage		Optimax2010	
Erstellt/drawn		30.10.02 FFW	Gepr./Verified 30.10.02/Sur/MW Freigabe/Approved 30.10.02/Su/PFW
Art.-Nr. / Update-Nr.		Mikrom/Contr. IP-MW/PC/BNL	
Datum / Date		1 9.52.0374	
Name		Berthold/W./Hessler/W.	
Version / Revision		2/3	
		Zeichnungs-Nr./Drawing-Nr.	
		4.8.06.003.03 - 1	

9 Power Supply

9.1 Electrical connections

Electrical specifications are indicated on model nameplate.

Type 116x-1-x000	230 V ~ +/-10%, 8,8A, 50Hz
Type 116x-2-x000	230 V ~ +/-10%, 8,8A, 60Hz
Type 116x-9-x000	230 V ~ +/-10%, 7,1A, 60Hz for 110V Operation

Machine tested for overvoltage category II according to IEC 1010 (EN 61010, VDE 0411).

9.2 System protection

IP 20

9.3 Power consumption

Stand-by	0.12kWh
Processing	2.0kWh



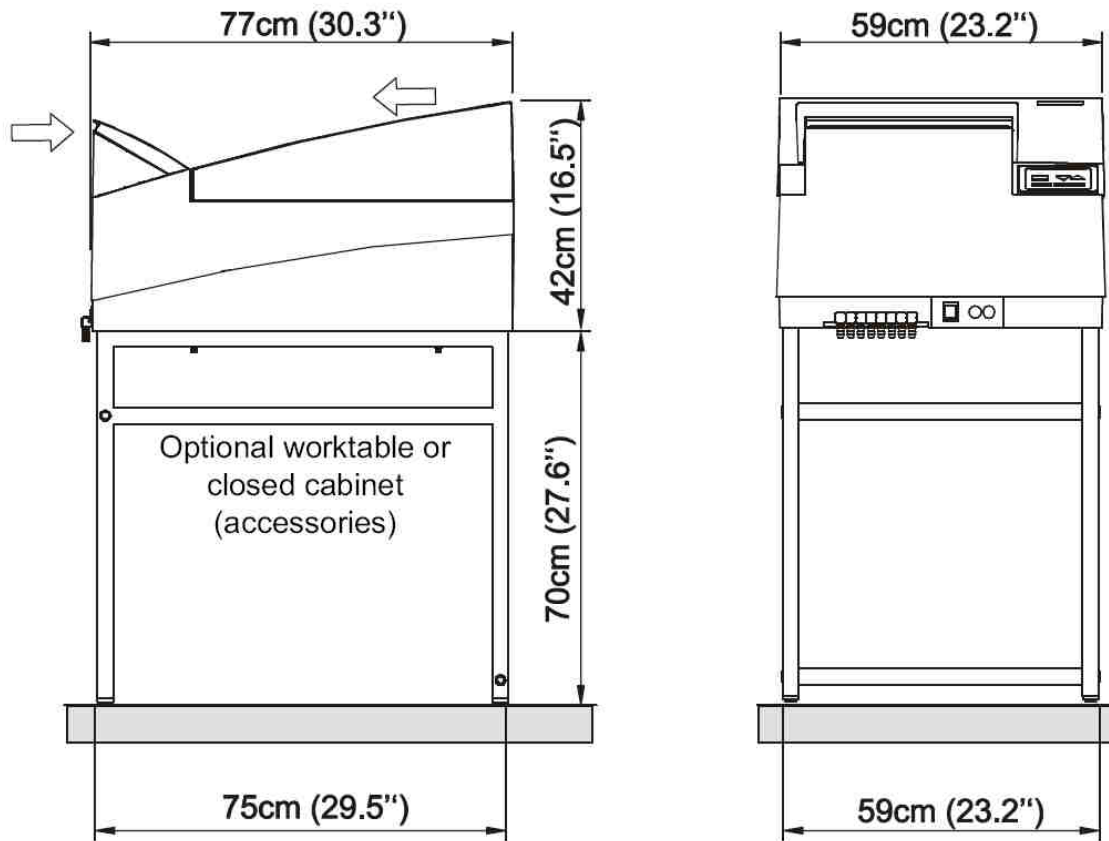
WARNING!

To lower the risk of an electrical shock, the device can only be run on a power supply with a protective conductor.

10 Technical specifications

Film transport	Continuous roller transport system
Film formats	In general: sheet films up to max. 35.8cm(14.1 ") width; Smallest film format 10x20 cm (4x8 "), 20cm (8") Infeed length, max. 2 films side by side, min. 5cm distance between the films
Processing capacity	78 films 24x30 cm, crosswise, (10x12 ") shortest processing time.
Processing time	2.5 – 10 min.; adjustable in steps of 0.1-min.
Linear speed	8.4 – 35.0 cm/min., depending on selected cycle time
Developer time	41 - 164 sec, depending on selected cycle time
Tank capacities:	Developer, Fixer and water tank, 5 litres each (1.3gal)
Circulation system	Developer and fixer are continuously circulated by a circulation pump
Replenishment	Automatic by film surface measurement in relation to processed film; replenishment can be switched off; time replenishment can be activated
Developer temperature	Adjustable 26 - 37 °C (78 - 99 °F)
Fixer temperature	Adjustable 26 - 37 °C (78 - 99 °F)
Dryer temperature	Adjustable between 10 - 100% of dryer output, temperature achieved depends on line voltage
Water connection	Permissible water pressure 2 - 10 bar (29 - 145 psi), permissible water temperature 5 - 30 °C (41 - 86 °F)
Water consumption	1.9 litres per minute (0.5 gal/min) when processing. Water saving mode: 0.9l/min
Drain capacity	7 litres per minute (1.85 gal/min)
Noise level	Less than 58 dB(A)
Heat emission	Processing: 1.4 kJ/s
Pollution degree	2
Weight (processor)	Empty 35 kg (77 lbs) Filled 50 kg (110 lbs)
Dimensions (LxWxH)	77x59x42 (* 112) cm 30.3x23.2x16.5 (* 44.1)"
Floor space required	0.45 m ² (4.8 sqft)

* Height incl. optional working table resp. base cabinet.



10.1 Protection Art and Protection Class

The automated X-ray film processor consistent with a protection class I.

10.2 Environmental

10.2.1 Environmental conditions during operation




















Use	Only indoor
Ambient Temperature	Temperature 18 - 40 °C (51.6 - 104 °F), ventilated room, room temperature should be lower than set bath temperature.
Relative humidity	Relative humidity lower than 80% up to 31 °C (80 °F), linear decreasing to 50% at 40°C (104°F)
Atmospheric pressure	Height above sea level less than 2000 m (6666 ft.)











10.2.2 Environmental Conditions for Shipping and Storage

Ambient Temperature	- 10°C to + 70°C
Relative humidity	10% to 95% (non-condensing)
Atmospheric pressure	500 hPa to 1060hPa

11 Description of symbols, labels and abbreviations

11.1 Symbols

	Limitation atmospheric pressure
	Limitation temperature
	Limitation humidity
	Keep dry
	Fragile, Handle with care
	This way up
	Attention, consult accompanying documents
	CE-Mark
	Manufacturer
	Trade name
	Order number
	Serial number
	Date of manufacture
	With this symbol we point out that Usage instructions of the corresponding product is on our Homepage
	Notes on disposal; WEEE , Waste of Electrical and Electronic Equipment
	Protective ground (Earth)
	Warning of electrical voltage
	Warning in front of hot surface
	Display working parameters

	Arrow button „up“ increase parameter value
	Arrow button „down“ decrease parameter value
	Symbol processing time
	Symbol developer temperature
	Symbol dryer output
	Symbol replenishment time developer
	Symbol replenishment time fixer
	Replenishment
	Overflow
	Drain



11.2 Identification label

OPTIMAX 2010 NDT
Automated X-ray film processor

REF 1163-9-2800

SN SNxxxxxx

2025-07-09

www.protec-med.com/download

+18 °C +40 °C 1060 hPa 50%
700 hPa 80%

POWER RATING

220-240	V ~
60	Hz
7.1	A

Both phases are fused!
Prepared for voltage converter with 110-120V input!

CE

PROTEC
Member of REINSBERG GROUP

PROTEC X-ray Systems GmbH
In den Dorfwiesen 14
71720 Oberstenfeld
Germany

TL1163-9-2800V04

11.3 Labels

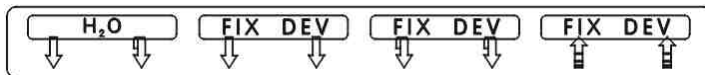
Corporate



Control panel foil



Designation hose connections



Description of the fuse

2x T / sb
10A 250V

Sticker water pressure

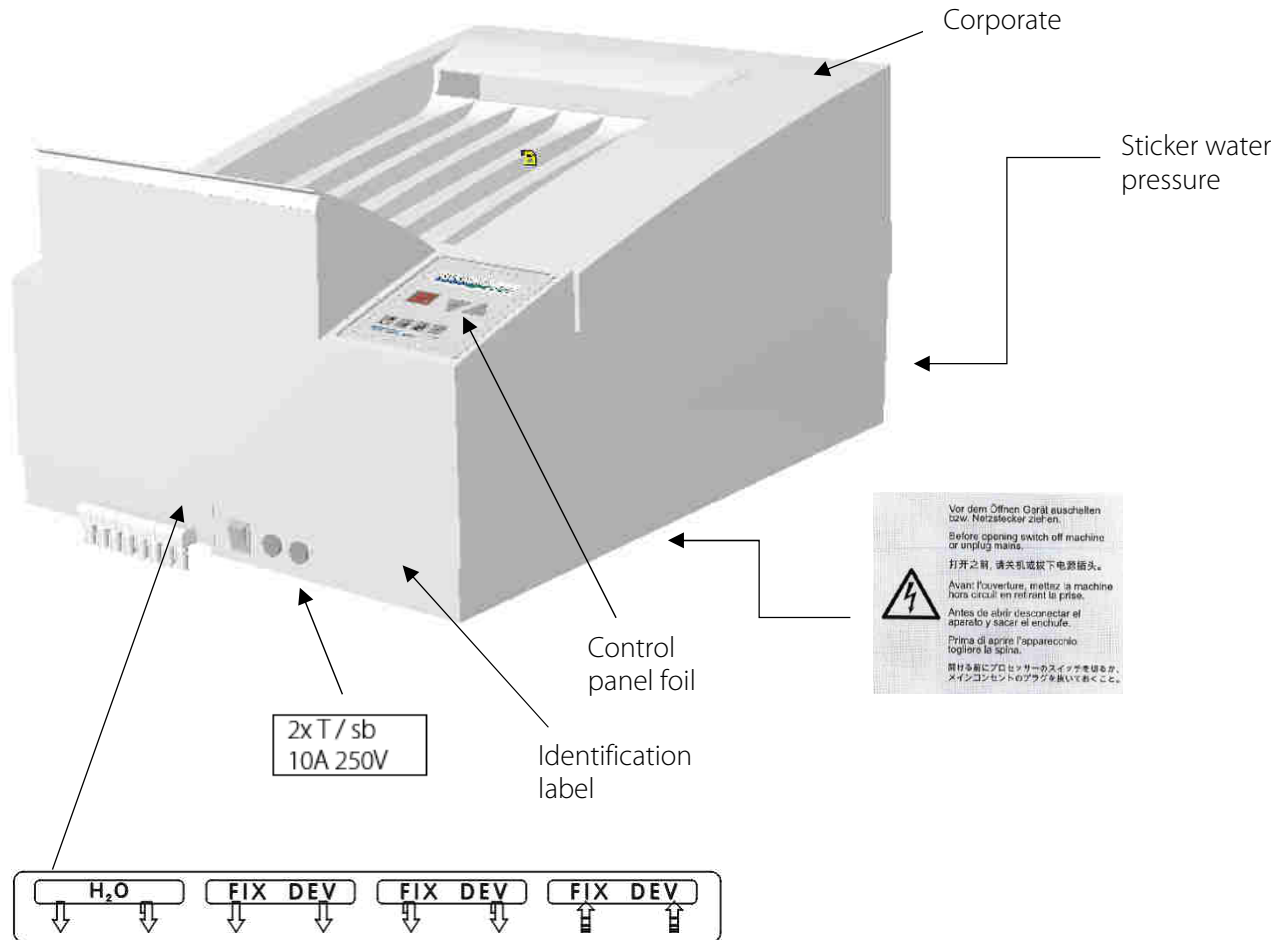
Wasseranschluß:	Zulässiger Wasserdruck 2-10 bar
Water connection:	Permissible water pressure 2-10 bar
Arrivée d'eau:	Pression nécessaire de 2 à 10 bars
Conexión de agua:	Presión admisible del agua: 2-10 bares
Connessione acqua:	Pressione ammissibile dell' acqua: 2-10

Sticker on the floor plate



Pull plug

11.4 Position symbols and labels



11.5 Abbreviations

mm	Millimeter
cm	Centimeter
lb.	Pound
kg	Kilogram
°C	Degree -Celsius
hPa	Hectopascal
DIN	German Industry Standard
EN	European Standard
CE	CE-Mark
Hz	Hertz
ED	Duty cycle
A	Ampere
SN	Serial number