SERVICE MANUAL

INDUSTREX M37 Plus

NDT - Filmprocessor

Software: AT600 v3.6d and up

03/2019 TK

ATTENTION !!!

PLEASE FOLLOW THE SAFETY INSTRUCTIONS IN THE

INSTRUCTION MANUAL

ATTENTION

ACHTUNG !!!

BITTE BEFOLGEN SIE DIE SICHERHEITSHINWEISE DER

BEDIENUNGSANLEITUNG

ACHTUNG

OBSERVANCE:

THIS SERVICE MANUAL CAN ONLY BE USED IN COMBINATION WITH THE CORRESPONDING INSTRUCTION MANUAL FOR THE **PROCESSOR**

THE INDICES IN THIS SERVICE MANUAL ARE AN ADDITION TO THE CHAPTERS IN THE

INSTRUCTION MANUAL !

ZUR BEACHTUNG:

DAS SERVICE MANUAL KANN NUR IN VERBINDUNG MIT DER BEDIENUNGSANLEITUNG VERWENDET WERDEN !

DIE INHALTE IN DIESEM SERVICE MANUAL SIND EINE ERWEITERUNG DER KAPITEL DER BEDIENUNGANLEITUNG !

THIS SERVICE MANUAL IS ONLY SUITABLE FOR QUALIFIED TECHNICIANS!

TECHNICAL SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE!

INDUSTREX M37 Plus
NDT-Filmprocessor

INDEX

THIS SERVICE MANUAL IS ONLY SUITABLE FOR QUALIFIED TECHNICIANS!

1. BEFORE THE INSTALLATION

*) Site preparation, e.g., water supply, drainage electrical supply must be completed prior installation.

1.1 LOCATION

*) Processor can be installed "through-the-wall" or completely in the darkroom.
Required measurements can be taken from the processor specification sheet.
For "through-the-wall", a panel built for that purpose is required (optional accessory).

1.2 ELECTRICAL SUPPLY

**Main switch of
the film processor**

**Power connector, a power cord
is included with the processor**

DANGER:
 **All electrical connections must meet national safety requirements. Correct fusing
and electrical requirements can be found in the processor specification sheet.**

DANGER

1.3 WATER SUPPLY

*) The processor must be connected to the local water supply by using a DVGW-approved system separating device or pipe separating device.

*) The cold water supply pipe must have a stop cock fit into the connection to the processor and should be done by using the 3/4" hose connector, supplied.
Easy access to the stop cock should be provided as it has to be opened and closed daily.

*) A built in magnetic valve reduces water consumption to a maximum of 2.5 ltr./minute using pressure and quantity control.

*) It is recommended to run a second cold water supply with 2.5 meters of hosing to facilitate easy cleaning of the racks and tanks (water supply kit - optional accessory).

NOTE:
*All water, drains and
replenishment connections
are located the front of the
processor (see next pages).*

2. TRANSPORTATION AND ASSEMBLY

The transport to the installation area can be easily done by two persons.

> *WARNING: DURING TRANSPORT ALL RACKS AND THE DRYER MUST BE TAKEN OUT OF THE PROCESSOR !!*

The installation site has to be prepared according to all the pre-installation specifications confirmed in the pre-installation manual. All local regulations in respect of water use, water drain and electrical regulations are to be considered. After the installation, a customer training in how to use the processor on day by day base has to be done. A signed confirmation of this training in writing is recommended to have.

After unpacking, place the processor in position and level the unit as shown below:

use a spirit level for leveling the processor
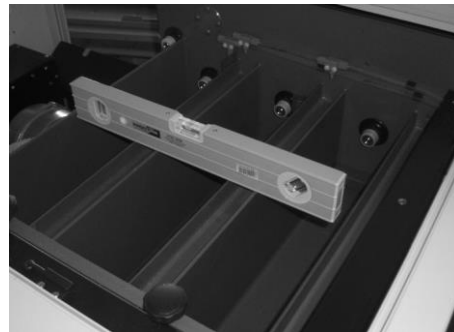
> *IMPORTANT: The Processor must be leveled for optimum performance.*

As a recommendation, place all the supply containers (waste and replenishment) below the processor - make sure all these containers are easily accessible.

rep. -tanks

Cover   *Cover*

FIX   *Standpipe* **DEV**

Filter   *Filter*
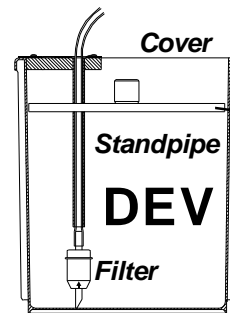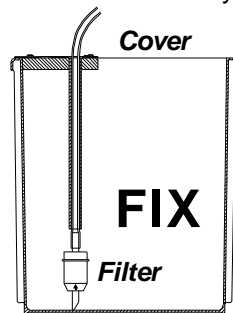
USE FLOATING LID TO PROTECT THE DEVELOPER AGAINST OXYDATION

waste collection tanks

> **IMPORTANT:**
> **Used developer and fixer have to be collected in suitable containers separate from each other !!**

3. INTERNAL WATER CIRCUIT

Tap1, Tap2 => to be used to set the flow rate
Make sure that the 2 taps are adjusted according to the local water pressure to prevent over splashing inside the processor!
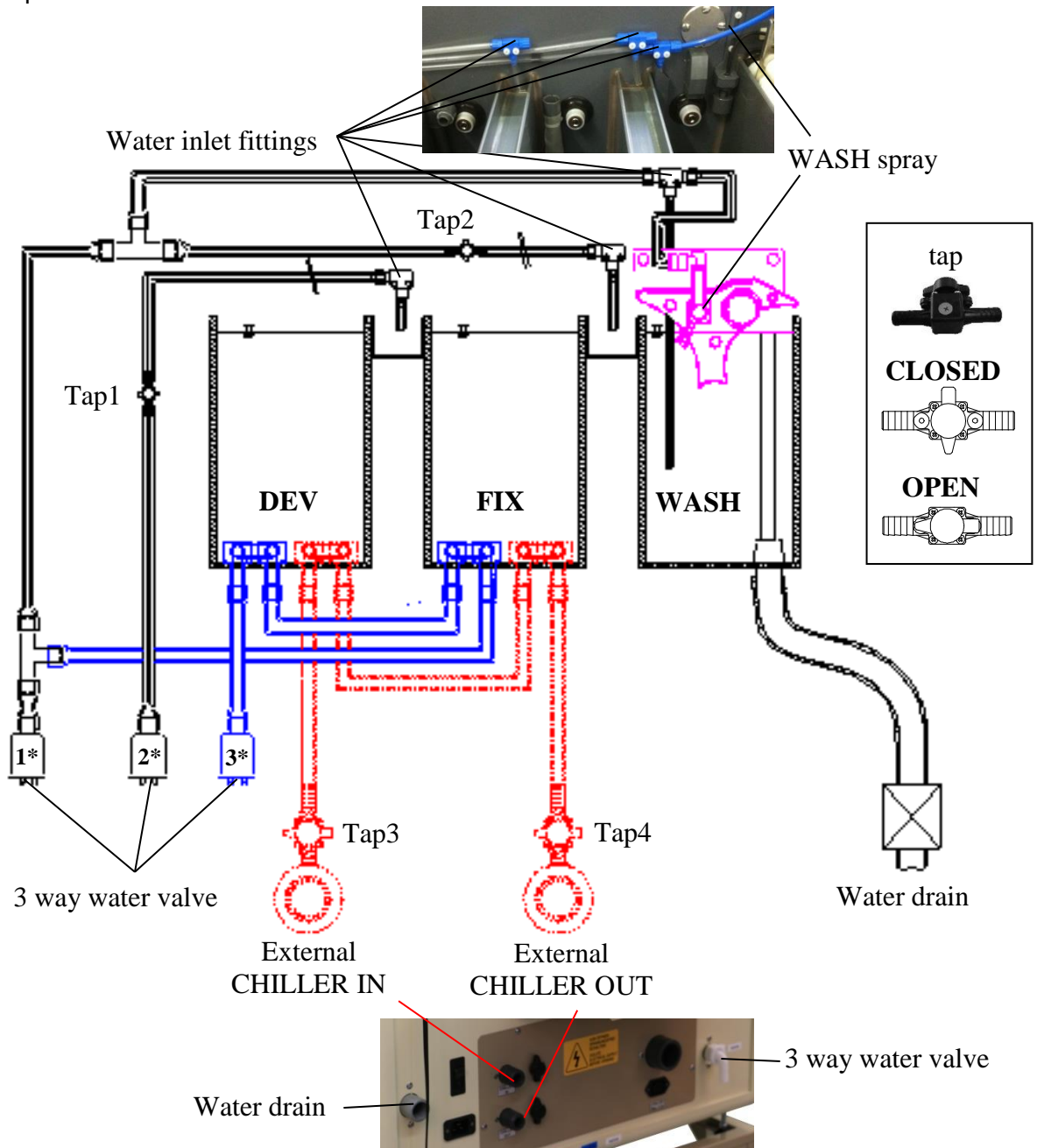
*) The processor features a 3 way automatic water valve:
1 for the WASH tank, WASH spray and for rinse FIX/WASH
2 for rinse DEV/FIX
3 for water cooling (DEV & FIX)

OPTION: As an option it's possible to deactivate the water for the rinse between DEV / FIX and only activate it right after switching on the processor for cleaning purposes - it is then not active during normal processing.

3.1 COOLING

Cooling of the chemistry (DEV/FIX) of the processor is possible in two ways:

a) Water cooling (BLUE - STANDARD):
When using cold water (7-15°C) for cooling the chemistry, the "3rd" water valve is used.
The cold water flows through the pipe DEV1 which is located in the DEV-Tank and then through the pipe FIX1 in the FIX-Tank. The water flows then into the WASH circuit and will flow into the WASH Tank, WASH spray and the rinse FIX/WASH.

b) External cooling (RED - OPTIONAL):
When using external cooling with cold water or a chiller unit for cooling the chemistry, the hoses "CHILLER IN" and "CHILLER OUT" are used.
The cooling liquid flows through the pipe DEV2 which is located in the DEV-Tank and then through the pipe FIX2 in the FIX-Tank.

It is not recommended to use both cooling methods in parallel!

3 way water valve

External CHILLER IN

External CHILLER OUT

Temperature sensor for incoming cooling water
When the temperature is outside of a programmed range, a beeper brings an error to the operator, but does not affect the operation of the processor.

electrical connector for switching on/off external chiller device
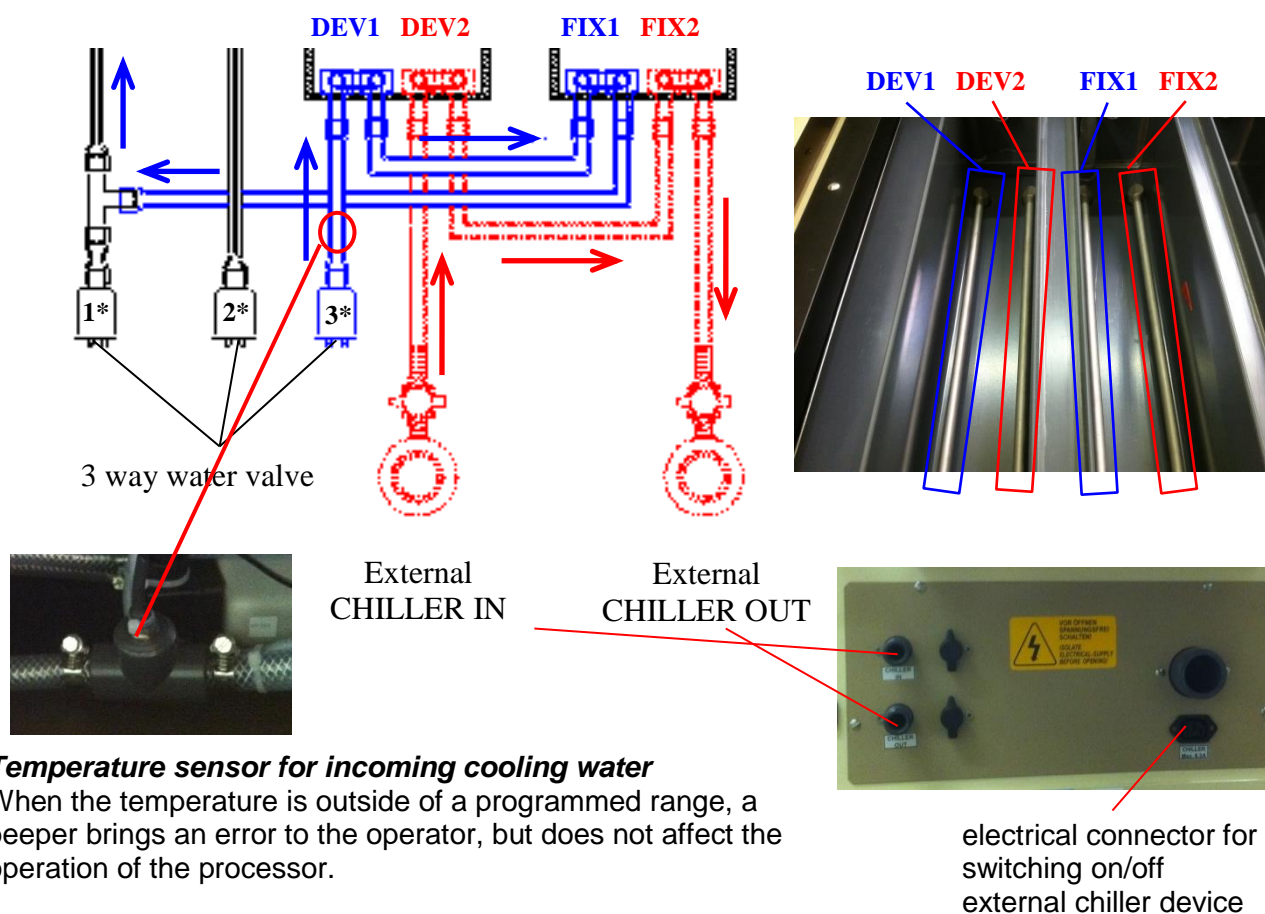
How to use the external cooling:

Remove the Film basket

BE SURE THAT THE PROCESSOR IS DISCONNECTED FROM POWER SUPPLY!
Open the electro box
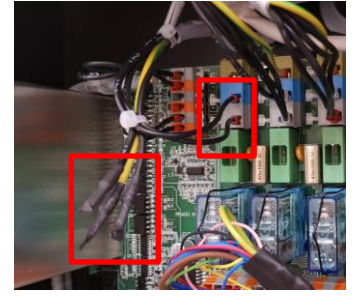
Rewire ST21 "cooling valve" in the electro box
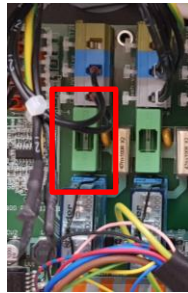
Change fuse F9 to T6,3A

fix the new cable with some cable clips and isolate the old cable and close the electro box

connect one hose to connection for „chiller in"

connect the hose to connection
from the chiller for „chiller out"

connect one hose to connection for „chiller out"

connect the hose to connection
from the chiller for „chiller in"
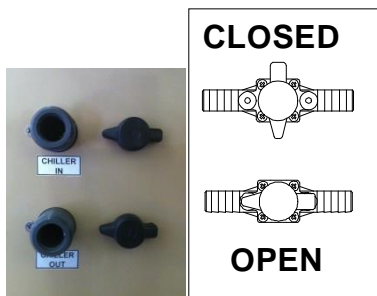
Open the taps

CLOSED

OPEN

connect chiller cable to electrical connector of chiller

connect chiller cable to electrical connector „chiller" of processor

How to fill the chiller:

Open top cover of chiller
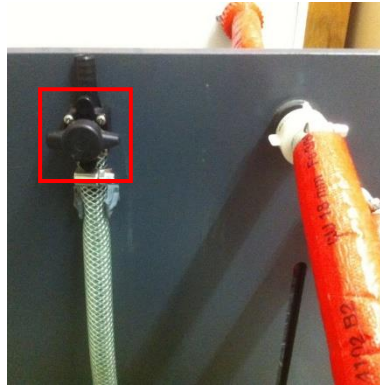
Make sure that the drain tap is closed

Inside view

Open cover of reservoir

Fill the cooling liquid into the reservoir

Close the reservoir

Now activate the chiller manually to fill the chiller system in the processor:

```
P1 Ready
T1=26.0°C (26.0)
```

Press ⚙

```
Program Setup
Options
```
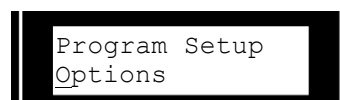
Use ➡ to move to **_Options_** and confirm with ➕✓.

```
Standby Refill
Filter  Service
```
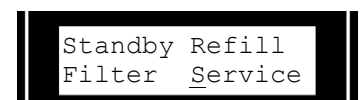
Use ➡ to move to **_Service_** and confirm with ➕✓.

```
Inputs  Outputs
Batt    DFU
```
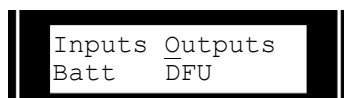
Use ➡ to move to **_Outputs_** and confirm with ➕✓.

```
1 2 3 4 5 6789aM
0 0 0 0 0 000100
```
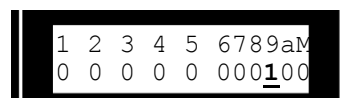
Use ➡ to move to bellow the number **9** and confirm with ➕✓. So the character will switch to "1" and the output for cooling is activated

When the chiller is running for a minute check that the level of the cooling liquid is not too low (the pump is sucking air) and check the hoses on tightness.

3.2 WATER DRAIN

*) The wash water should be drained separately according to local environmental regulations. The Processor comes with the suitable hose connections / plumbing materials.

*) The level of the water drain should be as low as possible with a minimum drainpipe diameter of Ø40 mm.

overflow.....1*

circulation inlet pipe   water overflow

drain collector
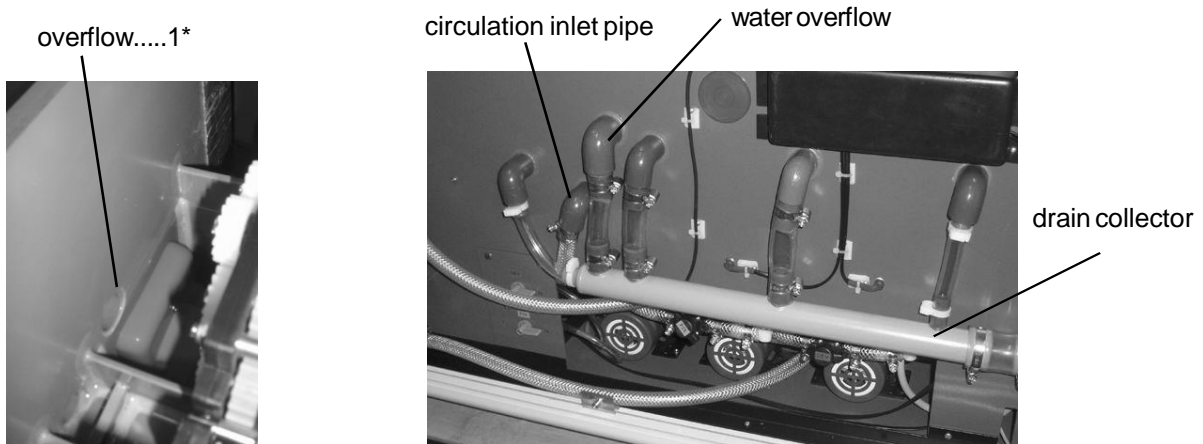
Make sure all hoses and fittings are free from any algae and or deposits. Regular cleaning and maintenance is required.

water in

overflow.....1*

level

WASH TANK

drain collector

circulation pump

WASH CIRCULATION...*
*....for better und more efficient washing

to drain the wash tank

drain taps

CLOSED

OPEN
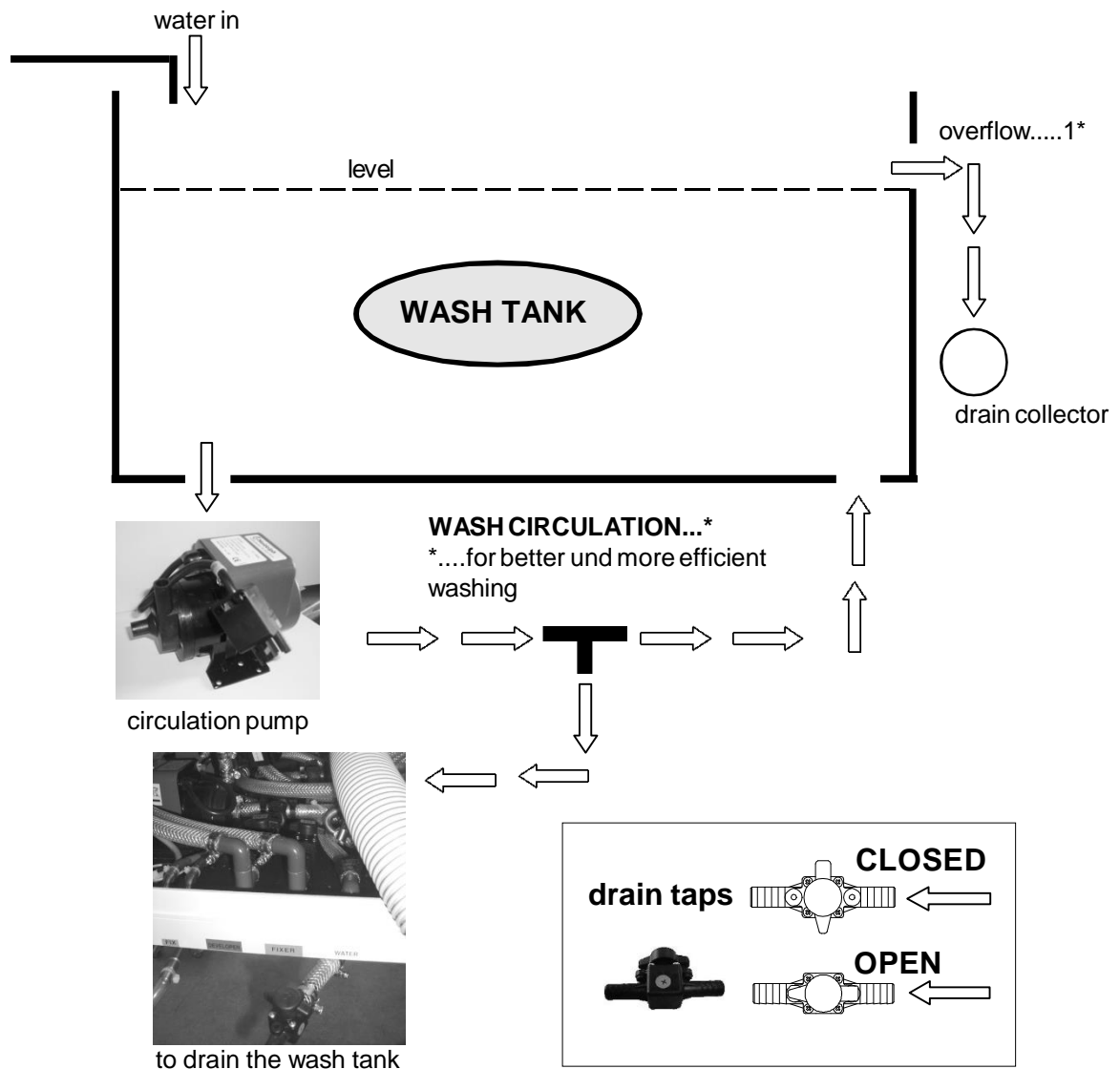
4. INTERNAL CHEMICALS CIRCUITS

The developer and fixer tanks are circulated and heated, the drawing below shows the function and components used:

DEV / FIX

> *NOTE:*
> There is an additional filter unit installed for the DEV.
> See next page......

Level

Level / Overflow tube

Circulation

WASH CIRCULATION...*

Circulation pump

Drain

Heat exchanger incl. cooling

Overflow

drain taps **CLOSED**

OPEN
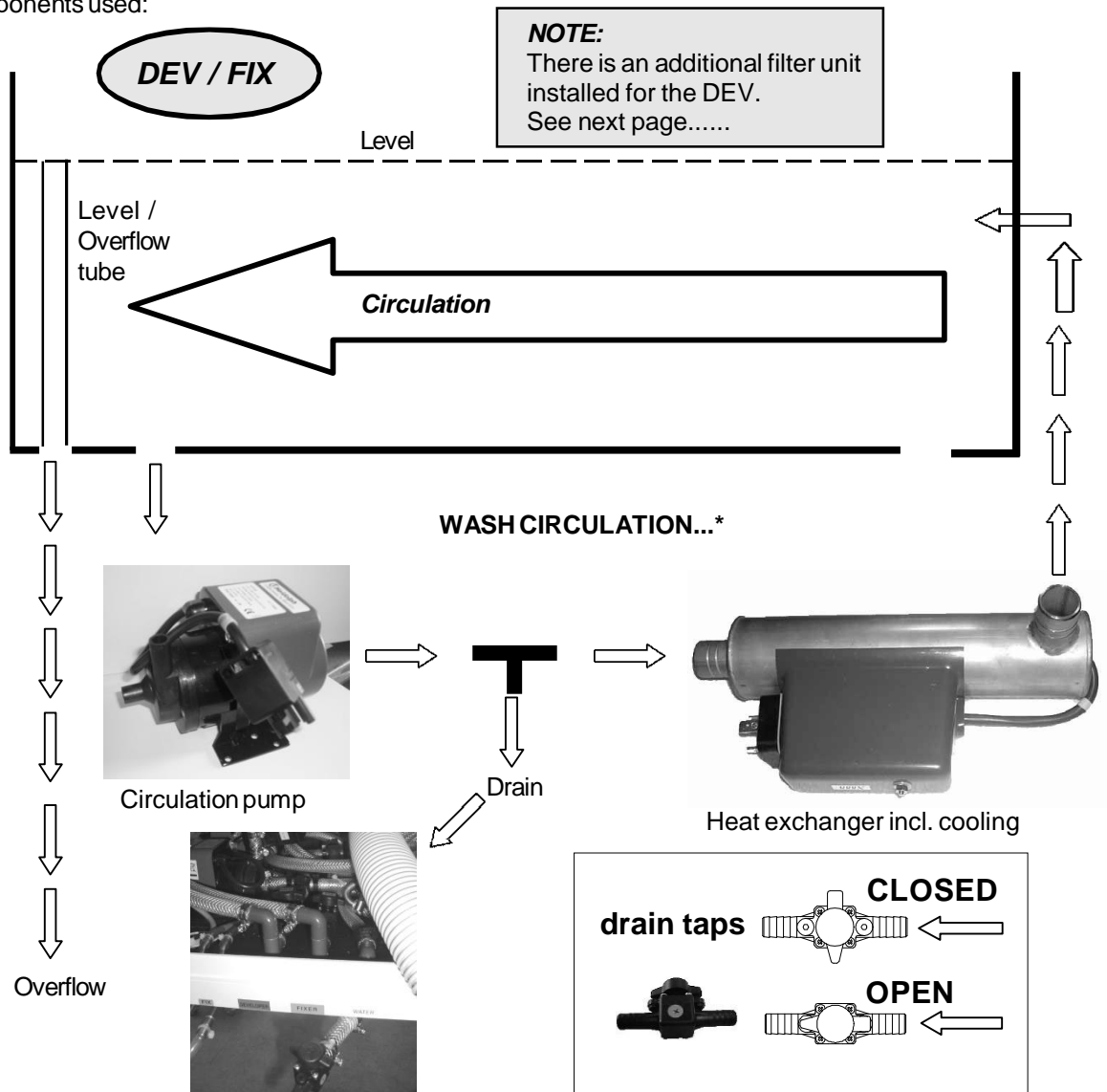
CAUTION:
Before draining the DEV and/or the FIX tank, please ensure the corresponding containers have enough "free" volume available.
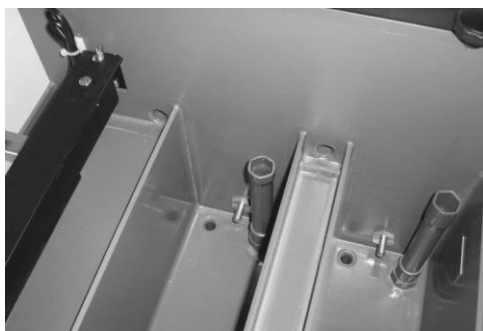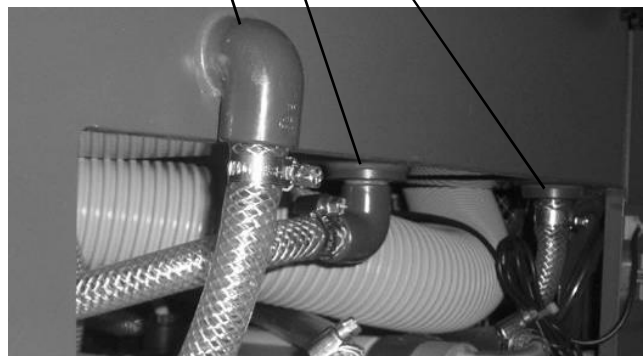
Circulation inlet pipe for
DEV   FIX   WASH

Level / Overflow tubes

4.1 DEVELOPER AND FIXER FILTRATION

Developer filtration:

The developer chemical recirculation has a closed filtering system. This filtering system is monitored and the processor reminds the user automatically, when the filter cartridge needs to be replaced.
This is done the following way:
The software of the film processor counts the surface of the film material that is processed by measuring the width of the film with the sensorbar and counting the steps the conveyor takes to lead the material through the process.
If the calculated area exceeds an adjustable value (0-9999m²) - default is 400m² - the software will come up with an error message, that the filter has expired and therefore needs to be replaced.

Filter housing

Filter cartridge

The control panel will show: | Change filter |

| CAUTION: | The replacement of the filter cartridge must be performed by a qualified service technician !! |

CAUTION

To replace the filter:

1) Switch off the processor and open the side panel to access the filter housing.
2) Unclip the filter housing at the upper clamp (beware of the liquid level when opening)
3) Open the top cover by unscrewing the handle.
4) Remove the filter cartridge and slowly put the new one in.
5) Screw the top cover of the filter unit back on.
6) Unclip the filter housing completely now and lower it (to get the residual air out).
7) Switch the processor back on and wait for the circulation to purge the developer circle through.
8) Clip the filter housing back in and close the side panel again.

**After replacing the filter the calculated area value needs to be reset in the software:**

To do so press ▶ to display the error message "Change Filter". Then press ⚙ to access the setup menu. In the setup menu press ➡to move the cursor to "Filter" then press ✚✓
In the "Filter" menu move the cursor to "Log" and press ✚✓ again.
In the "Log" menu choose "Clear" to reset the counter to zero.

Fixer filtration:

The fixer chemical is filtered by a filter hose on the recirculation stream-in pipe. This pipe can be unscrewed with a hex key. Please check and clean or replace this filter as well if You replace the developer filter.

Fixer filter

4.2 AUTO REPLENISHMENT SYSTEM

Whenever photographic material is processed, chemical components of the processing solutions are used and by-products are left behind in the processing solutions. Replenisher solutions are formulated to restore the chemicals to their original activity and to dilute the by-products to a correct level. It is therefore necessary to add the proper amount of replenisher for the amount of material that has been processed. Performed automatically by the film processor by way of infrared sensors installed across the complete feed width of the processor.

External developer replenisher tank   *External fixer replenisher tank*
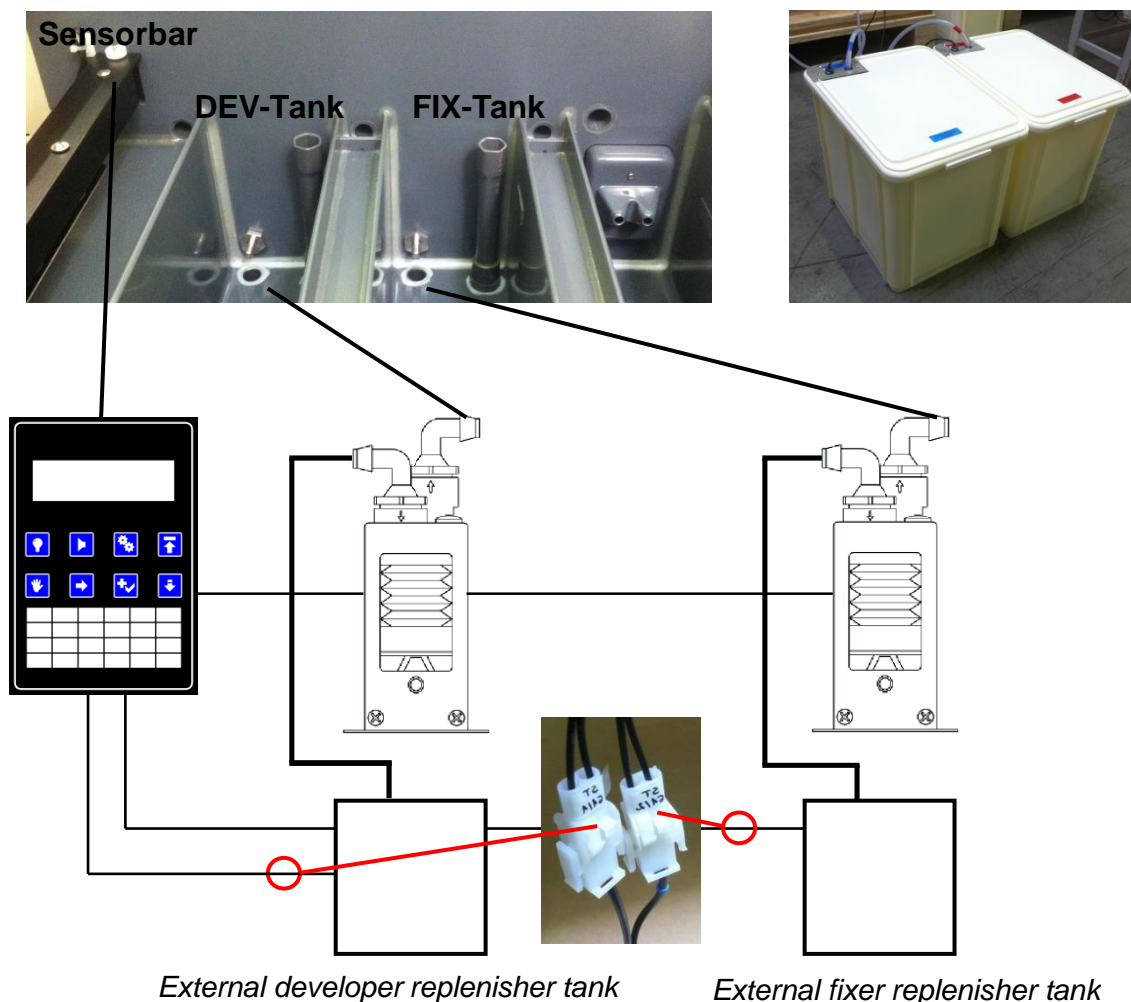
These sensors emit pulses of infrared light which has no effect on photographic emulsions. When media is beneath the sensorbar, the pulses are reflected and detected by the sensor. The pulses are transmitted to the control panel where they are „counted" by the microprocessor. When the number of pulses reaches the amount that has been programmed on the microprocessor, the replenishment timer function starts.

The replenishment timer runs the replenishment pump(s) for the number of seconds that have been set on the microprocessor. When the replenishment pumps are activated, the replenisher solutions are pumped through filters located at the bottom of the external replenisher tanks to the chemical tanks. The replenisher tanks are outside of the film processor.
The filters should be checked monthly and be cleaned or replaced if necessary.

DANGER:	**Separate the film processor from mains. To do so, switch the main power switch of the processor to the „0" position. Wear safety goggles, protective gloves and clothing.**

DANGER

4.3 ADJUSTING THE REPLENISHMENT PUMPS

> **NOTE:** If you just have made the experience, that one replenishment rate of a certain program is too high or low - just set the replenishment rate in the program and leave the mechanical setup of the pumps as it is.

Enter the "Manual" menu by pressing ✋ and move the cursor to "Rep" using ➡ and push ⭣ In the "Rep" menu You can see the two replenishment pumps "Rep1" and "Rep2".
By moving the cursor under one of the pumps and pushing ⭣ You can trigger the corresponding pump to deliver 100ml of liquid. Pushing ⭣ again increases the amount by another 100ml.

We recommend to use 400ml as a reference value.

When adjusting the replenishment pumps put the regeneration control hoses described before into a measurement cup with the capacity of at least 400ml and induce the referring replenishment pump to deliver 400ml of liquid (before that make sure to get all air out of the hoses by pumping a few hundred milliliters).
You can then compare the amount of liquid in the measurement cup with the amount You put in (400ml).

If this amount deviates from the reference value look for the scale below the pump bellow. It might be necessary to turn the pump by hand to get access to the setscrew.
The scale next to the setscrew shows a percentage range of 0 - 100%.
If You turn the setscrew clockwise by one turn it increases the setting by 10%, counterclockwise would decrease the amount of delivered liquid.

After changing the setting repeat the steps above to verify Your adjustments. When finished put the processor back in its original state and restart it.

Use a measuring cup like this to check the amount of liquid.

The replenisher pumps have to be adjusted by qualified personnel only.

Position of setscrew

> **NOTE:** Be sure to put the caps back onto the hoses and set the valves back to "N" (normal) after You have finished to adjust the replenishment pumps.

5. TEMPERING SYSTEM

The film processor supports an indirect tempering system to maintain processing solution temperatures accurately and efficiently. This tempering system is integrated into the recirculation. This system offers more efficiency and energy-saving.

circulation pump

heat exchanger with cooling
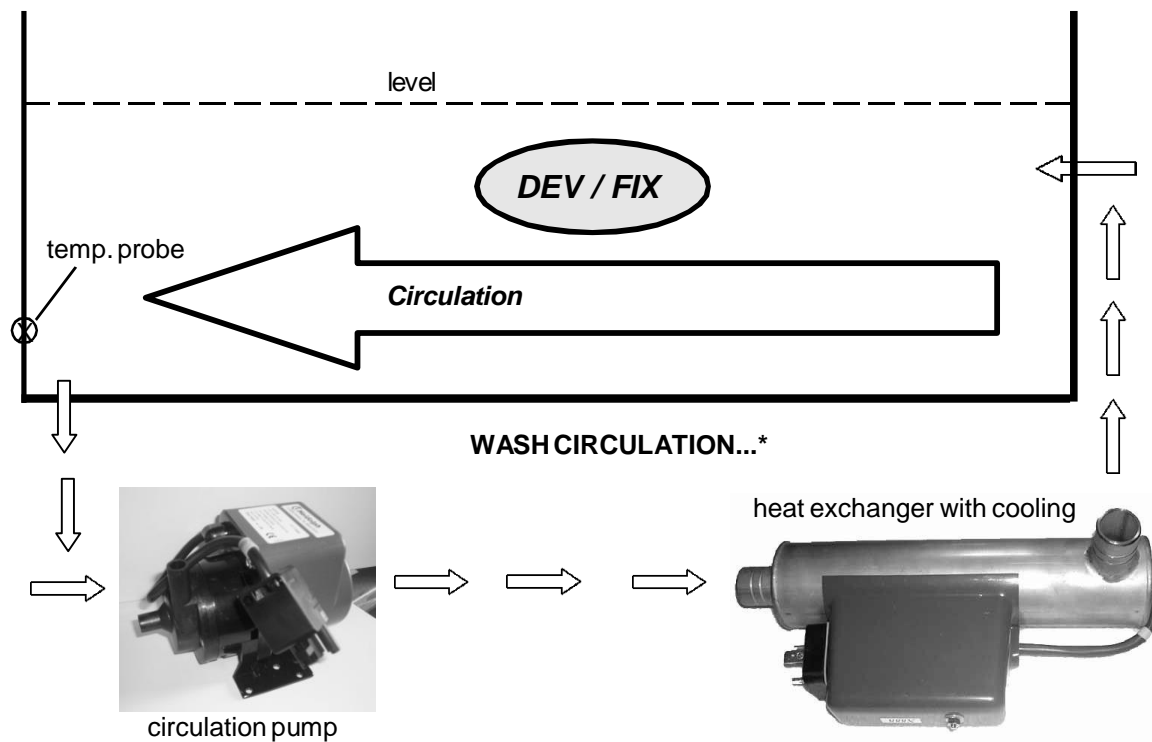
WASH CIRCULATION...*

The control panel in turn activates the circulation pumps and the tempering unit. The circulation pumps mix the chemistry to ensure even temperature throughout the entire tank. The drive motor also comes on during this period, to prevent build-up of chemical by-products on the processing rack parts during period of low usage. As protection against overheating most of the film processors are equipped with a „cold water" cooling system.

6. TEMPERATURE SENSING

The temperature probes in the tanks measure the temperature changes and activate the relevant heater control circuits within the main processor control system to maintain accurate solution temperatures.
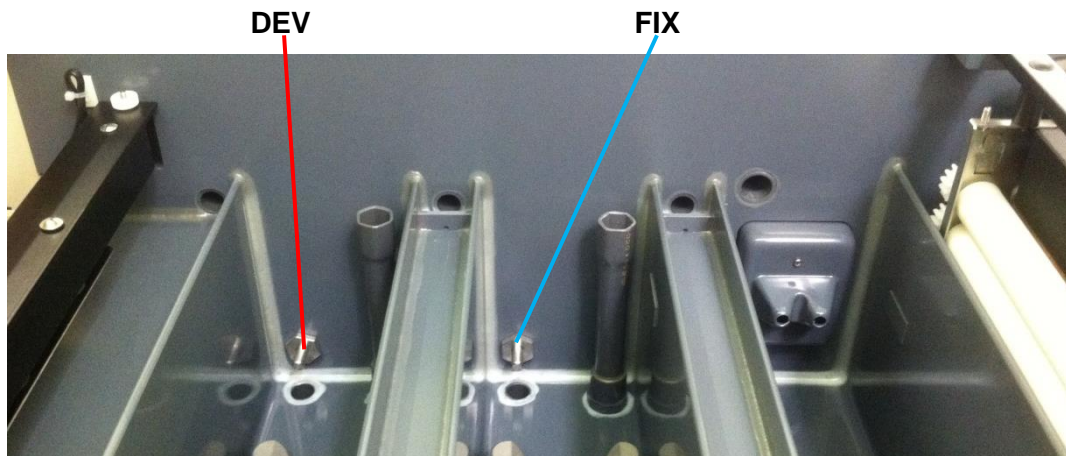
7. **I2C-BUS SYSTEM**

Probes positioned under solution levels precisely monitor all solution tank temperatures. These temperature probes are continuously supplying information to the microprocessor on actual solution temperatures within the tanks. The microprocessor then compares these actual temperatures to the required programmed "set" temperatures and controls the relevant heaters/cooling systems accordingly.

Bus-System	Measurement	Action
Temp. probe	Developer Temp. Fix Temp. Dryer Water IN Temp.	Heating/Cooling Heating/Cooling Heating Monitoring
Sensorbar	Incoming plate-area	Replenishment

NOTE: To transfer this information, a BUS-SYSTEM is installed.

OVERVIEW:
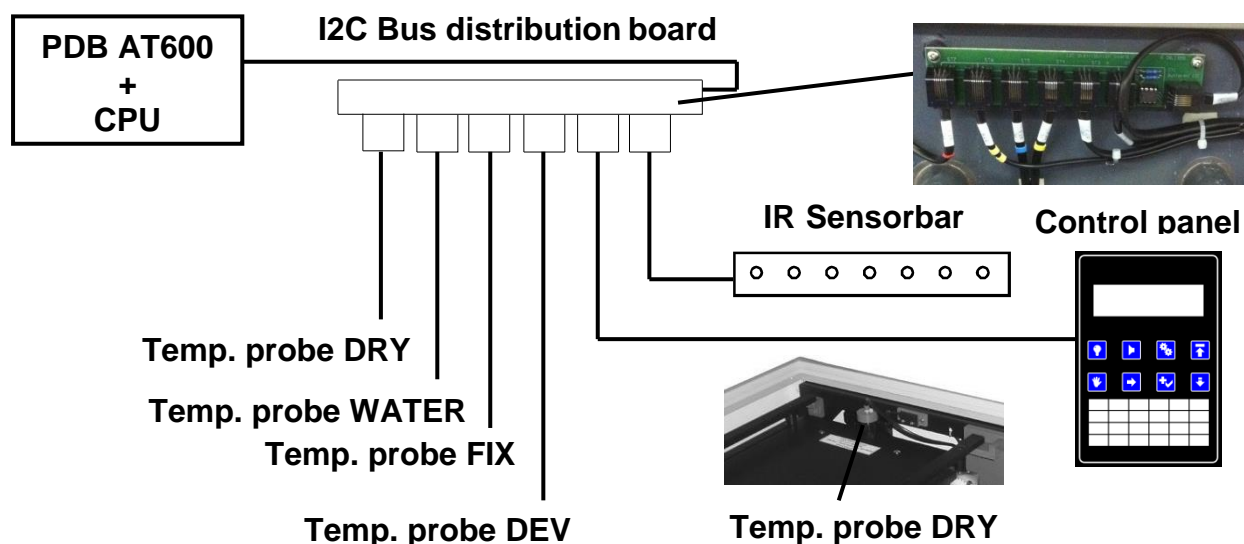
8. **VENTILATION**

To prevent crystallization and humidity inside the film processor a ventilation device is built into the processor. It is recommended to connect the tube mentioned below to an external exhaust device to prevent any possible problems.

CAUTION:	To install such a external exhaust device, is allowed to qualified service personnel only.

CAUTION

Electronic box: openings for ventilation - keep clear !!

exhaust tube connector

9. **THE FIRST STEPS**

> **DANGER:** **Separate the film processor from mains. To do so, switch the main power switch of the film processor to "0" position.**
> **Wear safety goggles, protection gloves and clothing!**

DANGER

9.1 ADDITIONAL TO THE FIRST STEPS

We recommend that the machine is fully water tested on installation before filling with chemicals – this is just a safety procedure in case of transport damage.

*)   Thoroughly clean the processor to ensure that no packing materials restrict the free
      running of the processor. Pay special attention to the racks and the inside of the tanks.
*)   Close the drain taps for the developer, fixer and wash.
*)   Fill the tanks (Dev, Fix and Wash) with water.
*)   Switch on the processor.
*)   Check for signs of leakage.

9.2 USING & HANDLING CHEMICALS

*)   Only use chemistry suitable for roller transport systems.
*)   Follow instructions of the chemicals manufacturer.

FIXER BATH:

*)   Empty fixer tank by opening the fix drain tap.
*)   Remove the fixer-rack.
*)   Check fixer tank is free of alien material.
*)   Close fix drain tap.
*)   Fill fixer tank with ready-to-use-fixer solution to the red marker on the tank wall.
      Insert the fixer-rack very carefully and slowly, add hardener solution if advised by the chemicals
      manufacturer.

DEVELOPER BATH:

*)   Empty the developer tank by opening DEV drain tap.
*)   Remove the developer-rack.
*)   Check if the developer tank is free of alien material.
*)   Close the DEV drain tap.
*)   Fill developer tank with ready-to-use-developer solution to the red marker on the tank wall.
      Insert the developer-rack very carefully and slowly. Replenishment tanks may be used to mix the
      chemicals. Any remaining developer can be used for replenishment.

> **NOTE:** **Even the smallest quantity of fixer could contaminate the developer solution. Therefore always fill the fixer first. When removing the fixer rack, always cover the developer tank. For removing the fixer rack use rack carrier tray (optional accessory).**

10. PROCESSOR FUNCTIONS

Programming:

Automatic processing parameters, e.g., temperature, speed and replenishment rates, can be stored in 9 different programs.

Warm-Up Time:

Once programmed, temperature settings are accurately controlled. Constant solution temperatures are maintained in the processing tanks. Temperature tolerances of +/- 0.2 °C are achieved by the microprocessor control unit while the solutions are circulated by circulation pumps.
When the temperature has reached the PRE-SET levels, the processor enters STANDBY mode and is ready for use.

Standby:

In case no film is in process - after a fixed period of time and after the last plate left the dryer, the processor transport, dryer and water supply is switched off automatically. The processor goes to standby mode. During standby, the processor activates two important features:
ANTI-OXIDATION and ANTI-CRYSTALLIZATION programs.

Anti-Oxidation:

During STANDBY mode - and in long periods of no production, a pre programmable ANTI-OXIDATION cycle (replenishment cycle) is initiated. The additional replenishment compensates the impact of air oxidation of the chemicals during standby mode and maintain chemicals levels in the tanks, in order to compensate evaporation of the water in the solutions.

Anti-Crystallization:

During STANDBY mode - within a programmable cycle period - the transport rollers and the gum pump are activated - this helps to prevent crystallization build-up on the rollers.

Automatic Replenishment:

The processor is equipped with a film area measuring system. Infrared sensors scan the incoming plate area and when the preprogrammed amount of plate (area) enters the processor, a replenishment cycle will be activated.

Automatic (Start-Stop):

Infrared sensors also automatically control the start cycle of the film processor. The film processor changes from STANDBY to RUN once a film has interrupted the light barrier. As the rollers turn, water is supplied to the wash tank and to the intermediate rinse bath system. Once the last film has passed through, the film processor reverts to STANDBY. The film can be taken out of the receiving basket or top cover lid.

10.1 ADDITIONAL SAFETY FEATURES

*)   Thermostat controlled solution heater with OVERHEAT PROTECTION and AUTO-RESET.

*)   Thermostat controlled dryer heater with OVERHEAT PROTECTION and AUTO-RESET.

*)   All electric motors are equipped with a THERMAL SWITCH and AUTO-RESET.

*)   Each electrical component is protected by a FUSE on the power distribution board (PDB).

FOR AUTHORIZED TECHNICANS ONLY

11. SETUP

The setup menu is for authorized technicians only!! Although it is possible to enter the menu to see data and even to change them, it is still necessary to set a jumper on the mainboard of the processor to be able to save any new data entered - the jumper can be set as follows:

Switch off the main power switch („0"-position)

Main power switch

Power distribution board
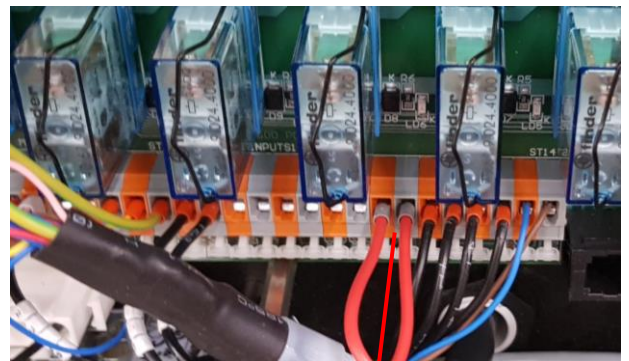
Jumper
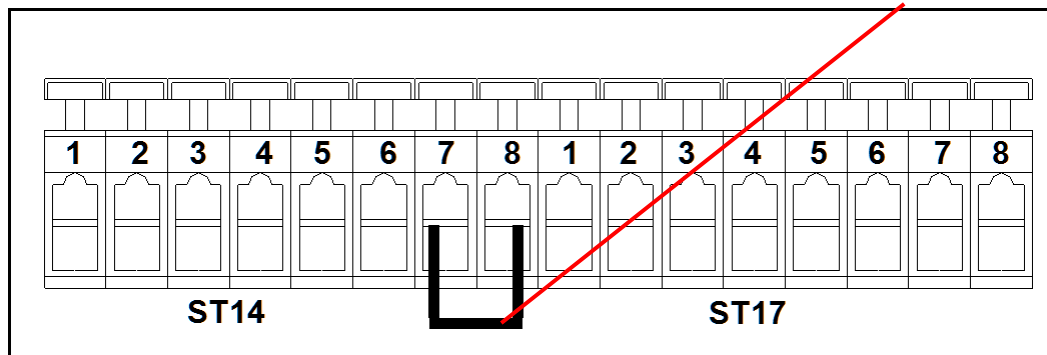
Set the program jumper on the PDB, plug ST14, pins 7+8

When selecting *Save* in the setup menu, the program will refuse to save the data unless this wire jumper is present.

NOTE:	DO NOT forget to remove the Jumper after service!

11.1 SETUP OF THE PROCESSOR

The Setup menu is for authorized technicians only! Within the setup, processor specific values and parameters are stored, those values are programmed in the factory during quality control and final testing.

> *NOTE:* **All factory settings and values can be taken from the processor factory datasheet**

To enter the setup, Switch on the processor, push ⚙ once and you will get:

| Program   Setup
Options | Use ➡ to move to *Setup* and confirm with ✚✓.
There are 8 pages, which depend on the mechanical construction and must be entered during the factory setup. |

next page with ⬇

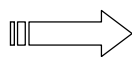| Tank 1   xxx pls
Dry end xxx pls | **Tank1** defines the number of pulses trough the developer rack
Dry end defines the number of pulses through the whole processor |

| Additional run
xxxx pls | **Additional run** defines the number of pulses that the system "adds" to the processing cycle after the film has left the processor. |

| Gear   .xxx pls/m
Pump ...xxx ml/s | **Gear** is the number of motor pulses corresponding to 1m advance of the material. It is needed to calculate the processed film area (for the replenishment) and the processing speed in cm/min.

Pump displays the milliliters per second that the replenishment pump delivers. |

| Sensor distance
xxx mm | **Sensor distance** is the distance between two sensors of the sensorbar. It is needed for the film area calculation. |

| Power save   X
(1-yes, 0-no) | **Power save:** If set to 1 (yes) the tank2 heater will be with switched off whenever the tank1 and the dryer heaters are on at the same time, regardless of the tank2 temperature. This is to keep the total power consumption in legal limits. |

| Replenish after
each 0.125 sq.m. | **Replenish after**: This is the area, after which one replenishment cycle starts. |

| Dry crossover x
(1-yes, 0-no) | **Dry crossover** displays if the **auto cleaning cycle** for the crossover between DEV to FIX as active or not |

| Cross over on for
xx min after on | Displays the time of the **auto cleaning cycle** for the crossover between DEV to FIX. |

| Tank 3 circulat. x
(1-yes 0-no) | **Tank 3 circulat**: When the Tank 3 has a circulation pump then the software waits until the water level is ok. Select "0" when there is no circulation pump. |

| Water refill
time-out xx min | **Water refill time-out:** Timespan in minutes where the water tank has to be refilled after switching on the device. |

| Feed film if dev
temp is high - x | **Feed film if dev temp is high** is used to enable the feed in of films even when the DEV-Tank temperature is too high. |

| Feed film if dev
temp is low - x | **Feed film if dev temp is low** is used to enable the feed in of films even when the DEV-Tank temperature is too low. |

```
Water-In Min:xx°
Water-In Max:xx°
```

Water-In Min is the lower temperature level for the incoming water for cooling.
Water-In Min is the lower temperature level for the incoming water for cooling.

```
Film feed if wat
low-x 1-yes 0-no
```

Film feed if wat low is used to enable the feed in of films, even when the water level is low. Select "0" when there should not feed a film with low water level.

```
Min. tanks heat
OFF time  20
```

Min. tanks heat off time defines the minimum off time for tank heating elements after they have been deactivated even if a heat request appears within this time span.

```
Dryer Mode 1
```

Defines if the dryer is temperature controlled (1) or Operated with constand heating power.

```
Save  Cancel
```

Use **Save** to save your adjustments (The *setup jumper* described before has to be installed and LD9 is on!) or use **Cancel** to leave without saving.

11.2 DEFINITION OF PULSES

Sensor point "0"

DEV   **FIX**   **WASH**   **DRY**

Additional run

Tank1 pulses (DEV only)

Dry end pulses whole processor incl. dryer
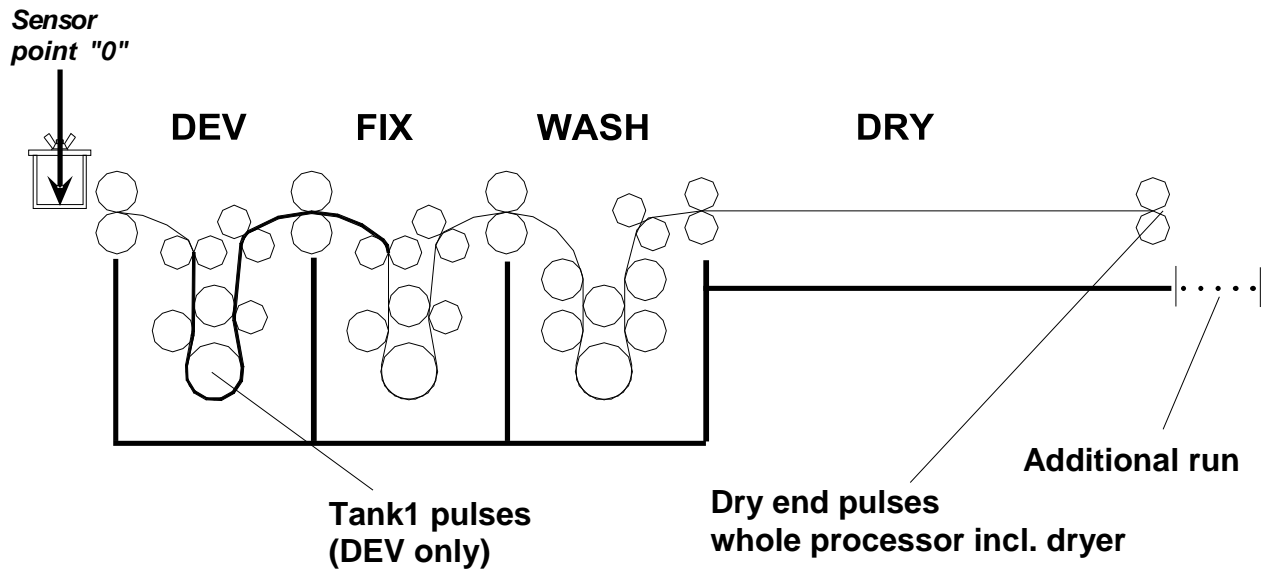
11.3 INIT PROCESSOR

In addition to that this software always „remembers" the status for the case of a sudden power failure. Which means after powering the unit up again, the processor continues to work where it stopped.
It might be necessary to interrupt this.

To do so press und hold the ✿ button and switch on the processor.
You will get: **Init Processor? Press OK** .... if you want to do so, push ✛ to confirm.

By doing so, the processor will restart and will clear all previous conditions.

Start up recovery procedure:

If the unit gets powered up, but does not start - besides CPU and Software issues, a problem with the I2C bus might be the reason.
Following procedure helps to identify I2C issues - followed by corrective actions.

Identification of a not starting unit:
- After switch in, the backlight of the display is ON,
- the first line shows black squares
- the second line of the display is blank
- No reaction to display buttons, all outputs on the main board off

Recovery procedure:
- Switch off the unit
- disconnect ALL I2C connectors from main board
- connect a service display instead of the original display
  (if not avaliable proceed without any display connected)
- with a spare display connected switch on the unit and check for initialization message
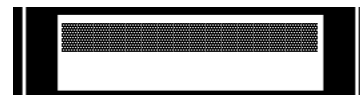 (with no display connected make sure, all levels in the tanks are ok and the cover switch
  is closed - and if installed the emergency stop button is NOTpressed)
- If the unit now starts up and runs the circulaiton pumps, a bus problem caused the
  problem
- Switch off again, and reconnect one after another bus component, beginning with the
  original display - disconnect the service display before switching on
- Switch on again after each component and check which one caused the problem.

If after reconnecting all original components the unit starts up normal, most likely chemical deposits on the I2C plugs caused a short circuit bewteen the Clock or Data signal and caused the unit not to start up.
Check all I2C plugs for deposits and gently clean if required.

If the unit still does not start up, connect to the Service PC and Start the Software FLIPS.
Check if the unit can be acessed via USB connection - If yes reinstall the firmware.

To do so follow the Firmware update procedure - coming with the unit documentation.

If the unit still does not start up, change the CPU card.

12. **FLOWCHART**

♀ **back light ON/OFF**
▶ **check errors /alarm shutdown**
⚙ **setup mode**
⬆ **back to top menu**
✋ **manual operation**
➡ **move cursor**
↴ **select menu item/change value**
⬇ **scroll page down**

__Setup__

```
Tank 1    0061p
Dry end   0240p
⬇
Additional run
0015 pls

⬇
Gear   160pls/m
Pump   4,0ml/s
⬇
Sensor distance
72 mm
⬇
Power save   0

⬇
Replenish after
each 0.125 sqm
⬇
Dry crossover 0
(1-yes 0-no)
⬇
Crossover onfor
05 min after on
⬇
Tank 3 circ  1
(1-yes 0-no)
⬇
Water refill time
out 10 min
⬇
Feed film if DEV
temp is high 1
⬇
Feed film if DEV
temp is low 0
⬇
Water in MIN 07,0
Water om MAX 19,0
⬇
Feed film if WAT
low          0
⬇
Min tanks heat
OFF time    10
⬇
Dryer mode    0
0=Power  1=Temp
⬇
Save Cancel
```

PRESS
▶

```
P1 Ready
T1=26.0°C (26.0)
```

```
P1 Heat up   Er
T1=20.4°C (26.0)
```

```
Errors:   1
Tank1  too cold
```
⬇
No more errors

PRESS
⚙

```
Program  Setup
Options
```

__Program__

```
P1 Modify
Time
```

__Px__	__Modify__

```
P1 Modify        Tank1 time 085s
↴                T1 26.0 C
P2 Modify        ⬇
↴                T2 28.0 C
P3 Modify        T3 max 50.0 C
↴                ⬇
...              Dryer power 20
P7 Modify
                 ⬇
                 R1 0700ml/sqm
                 R2 1400ml/sqm
__Time__         ⬇
                 Save    Cancel
Date: dd.mm.yy
Time: hh:mm:ss
⬇
Save    Cancel
```

PRESS

```
P1 Ready
T1=26.0°C (26.0)
```

⚙️

```
Program  Setup
Options
```

Service

```
Inputs   Outputs
Motor    DFU
```

Options

```
Standby  Refill
Filter   Service
```

Inputs

```
12345678ABCDEFGH
0000000000000000
```

Standby

```
SB dryer temp
40
```
⬇
```
SB replenish:
100ml each 6 h
```
⬇
```
SB self-cleaning
20cm each 10min
```
⬇
```
Run dryer 15 sec
each 5 min
```
⬇
```
Save Cancel
```

Refill

```
Wash auto refill
0 (1-yes,0-no)
```
⬇
```
T1 auto refill
add 0000 ml
```
⬇
```
T2 auto refill
add 0000 ml
```
⬇
```
Save Cancel
```

Filter

```
Area   Log
```

Area

```
Filter alert
after 0400 sqm
```
⬇
```
Save Cancel
```

Log

```
0000.00
Exit Clear
```

Outputs

```
123456789abcde
00000000000000
```
⬇
```
Dac2=0   Dac3=0
Dac4=0
```
⬇
```
fghijklmnopqrstu
0000000000000000
```

Motor

```
On Speed:000 +-
I1=0 I2=0 r   0
```
⬇
```
Ch1 Value:0000+-
```

DFU

```
Firmware update
mode     No/Yes
```

PRESS

✋

```
Start  P1  Use
Rep      Monitor
```

✛⌄ **Start / Stop Motor**

Px

```
P1
✛⌄
P2
✛⌄
P3
✛⌄
...
P7
```

Use

```
P1 Ready
T1=26.0°C (26.0)
```
⬇
```
T2=26.0°C (26.0)
Td=37.0°C (45.0)
```
⬇
```
Rep1= 0700 ml/sqm
Rep2= 1400 ml/sqm
```
⬇
```
Tank 1 time 110s
Dry to dry   425s
```
⬇
```
Speed 22 cm/min
USB not conn.
```
⬇
```
Dryer pwr=26 65%
R1=1 R2=0 SSr=60%
```
⬇
```
123456789abcde
00100010100000
```

Rep

```
Rep1 100ml  ON
Rep2   0ml OFF
```

Monitor

```
DDDDFFFF
WWWWDDDD
```
⬇
```
Motor Off
Speed 15 001
```
⬇
```
Normal s-bar
Area=0.0000 sqm.
```
⬇
```
S-bar: ---------
-----------
```
⬇
```
H1=0  H2=0  H3=0
Fan=0 Wash=0
```
⬇
```
Refill1 0000
Refill2 0000
```
⬇
```
Filter area sqm
xxxx.xx
```
⬇
```
Total area sqm
xxxx.xx
```
⬇
```
Date: dd.mm.yy
Time: hh:mm:ss
```

13. **PROCESSOR SERVICE MENU**

Inputs:

The Inputs of the board are connected to the Power distribution Board via the connectors ST14 and ST17.
They can be accessed by pressing
3 then enter Options ->Service ->Inputs.
The Inputs 1 - 8 correspond the Inputs on the board.
An opened input is displayed as 0, a closed input is displayed as 1.

```
12345678ABCDEFGH
0001000100010011
```

Outputs:

The Outputs of the board are switching the on board relays (1 - 9) and the external relays
(b, c, d). They can be controlled by pressing
3 then enter Options -> Service -> Outputs.
The Inputs 1 - 9 correspond the relays mounted on the board, b, c, d
control the external relays - normaly used for dryer control.
When entering all Outputs are off, changing to 1 switches on the Output
immediately. Refere to the electrical drawings, to avoid forbidden states
(dryer heaters without fan - circulation without water, ...)

```
1 2 3456789abcde
0 0 001001100000
```

Main drive Motor:

The main drive motor is a self monitoring BLDC drive, to test this motor
independed from the set program / setup parameter press
3 then enter Options -> Service -> Motor.
ON / OFF switches the Enable / Disable signal of the
Motor.
With +/- the speed can be set - 200 is the maximum speed, values
close to 0 lead to a stopped motor.
I1 and I2 represent the Error State and the Motor Speed pulse signal.
r shows the actual motor speed.

```
On  Speed:200 +-
I1=0 I2=1 r    0
```

NOTE:

**Outputs and Main drive motor will be inoperable if the emergency stop /
cover open state is active.
When testing Motor / Outputs make sure, the safety systsem in active state.**

DFU:

If the firmware of the device needs to be changed, install the
protection bridge on the CPU card. With this bridge installed, the
Firmware update can be initialized.
Refere to the procedure Device firmware update, to conduct a software change.

Bus System:
The bus System connects several components of the processor to interchange their data. On the used I2C bus, all members are on the same hierachy level. This means, any bus member can be connected to any free bus plug - the information flow is automatically organized.
If any bus component has a total electrical faliure, it can cause the bus to stop, and therefore the unit to fail - or not to start up - Follow the start up recovery procedure to locate the problem.

Temperature Sensors:
Temperature sensors are color coded. Each code MUST only be used once to avoid malfunction.
Refere to the technical documentation comin with the unit to see which code is used for which tank and the dryer.
A connected sensor will lead to a appropriate reading on the main pages of the display.
If the shown temperature is correct, there is no issue with the sensor.
A constant reading of 0.0°C indicates that the sensor has been shut down due to internal sensor faliure. In this case replace the sensor.
A constant reading „no probe" indicates that the sensor is not connected / defective.
In this case reconnect the sensor and check for bad plug contacts - if the problem
can not be solved by replugging - replace the sensor / board where the sensor is connected.

Display:
The Display is also a bus member - if both lines of the display show text, and every button pressed causes a short beep - all electronical functions are OK.
Pressing 💡 also will toggle the backlight.
If the display has the backlight on, the first line is black, the second one blank, then the bus communication failed – or the CPU card does not start up.
Follow the Start up recovery procedure to locate the problem.

Sensor bar:
The sensorbar is a member of the bus system. To check the sensorbar press ✦ to enter the manual menu.
Select Monitor, then scroll down with ✦ until the "S-bar:------" page is shown. The maximum amount of sensors are 20 -
2 decoders with 10 sensors each.
Refer to the electrical drawings to see the type of installed sensorbar.

```
S-bar:_____
_____
```

To check the sensorbar, move film underneath the single sensors and check if they are activated.
Active sensors will show their number.
For example - Decoder 1 has sensor 5,3,2,1,0 active.
For example -Decoder 2 has all 10 sensors active, Decoder 1 has sensor 9,8,7 active.
On some sensor bars, Decoder 1 and 2 do have less then 10 sensors, for example Decoder 1 and 2 have only 7 sensors.
A full reading then will show as following:

```
S-bar:_____
_____543210
```

```
S-bar:987654321
0987_____
```

```
S-bar:___654321
0___6543210
```

If a sensor is always active - or never active check the sensorbar for dirt accumulation as a first step - then remove the calibration coverage screw and increase / decrease sensitivity. If the problem can´t be solved replace the sensorbar / sensorbar components.
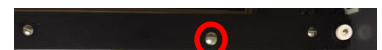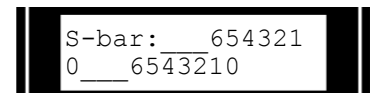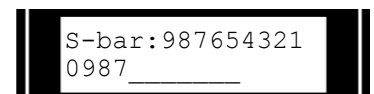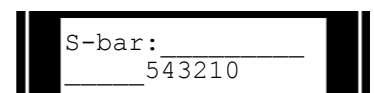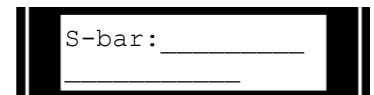
| Sensorcode: | 5 | 4 | 3 | 2 | 1 | 0+Decoder |

CPU card:
The units software is stored on the CPU card.
When changing the software for the processor, this can be done either by chaning the CPU card - or by loading the new software via USB interface.

To get access to the software installation menu, the flash memory protection has to be disabled.
To do so, remove the CPU cover and locate the protection pins,then install the update jumper.

To activate the software update function, with the installed bridge press 3, then select Options -> Service -> DFU
Select Yes to activate the update function.

Follow the firmware update procedure documentation coming with the units documentation to install a new software into the processor.

I2C distribution board:
The I2C distribution board allows to attach components to the I2C bus.
The normal version has 5 or 6 plug - oriented in the same direction.
Every plug can be used for each connection.
It is part - but not member of the I2C bus - it has no adress and only distributes / reinforces the signals beeing transfered over the bus.

The „buffered" version of this board - identifiable on the 90° rotatet plug ST1 is used to connect bus members via a longer wire to the main board. The signals over the connection wire to the main board are reinforced.
This cable has to be connected to ST1 - all other plugs can be used for each connection.

Non buffered version   Buffered version   ST1

Input extension board:
The input extension board is avaliable with 8 or 16 digital inputs. An opened contat means no signal, closed contact is used for active signal like low level, night cover, ...
The input extension board is member of the I2C bus. There are different versions, having different adresses. This allows to install more of them in the same processor.
If ordered always mention the version - which is marked on the board f. eg. V1.
To check the inputs of the board press 3 then enter Options ->Service ->Inputs.
The Inputs a -h correspond the Inputs on the board.
An open input is displayed as 0, a closed input is displayed as 1.
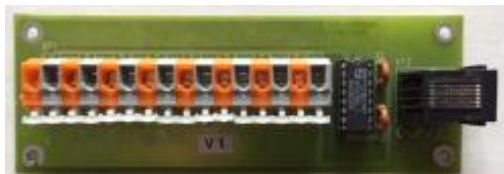

```
12345678ABCDEFGH
0100010110101011
```

Safety Circuit:
The processor is equipped with a Safety relais - monitoring the cover switches and if installed the emergency stop button(s). If the safety circuit gets interrupted, the safety relays deactivates the main power relais and disables the drive motor - as well as generates the Cover open signal. Refere to the electrical wiring diagram coming with the unit - page safety to have a complete overview of the safety system of your processor.

Motor:
The main drive motor is a low voltage brushless DC type, which has no maintainable
parts in it.
It has an independent monitoring electronics - protecting it from overcurrent, mechanical damage due to high torque, overtemparture and voltage fluctuations. The motor electronics comunicates with the processor, and problems with the motor are shown as error message on the user interface.

DANGER:
Switch off prcessor and disconnect from mains supply for this service task!

To access the motor following steps are required:

-)   remove the cover below the infeed table and the cover on the right side

-)   remove the chain protection cover plate

-)   loosen and swivel out the chain tensioner

-)   remove the screw holding the main drive sprocket in place

-)   lift off the chain from upper sprockets - then pull off the main drive sprocket from motor axle

-)   take care not to lose the fitting key which is plugged into the nut of the motor shaft

-)   remove the 4 screws which fixate the motor onto the tank body - when removing the last screw -
          secure the motor with one hand, to prevent it from falling down

-)   remove the motor trough the lower service cover on the front side (when viewed in transport direction
          of film)

-)   disconnect the motor and replace

To reinstall the motor follow the removing procedure in reverse order.

14. **I2C-BUS OVERVIEW**

Probes positioned under solution levels precisely monitor all solution tank temperatures. These temperature probes are continuously supplying information to the microprocessor on actual solution temperatures within the tanks. The microprocessor then compares these actual temperatures to the required programmed "set" temperatures and controls the relevant heaters/cooling systems accordingly.

To transfer this information, an I2C-Bus system is installed which is designed as follows:
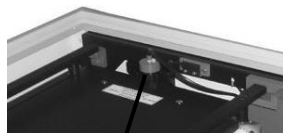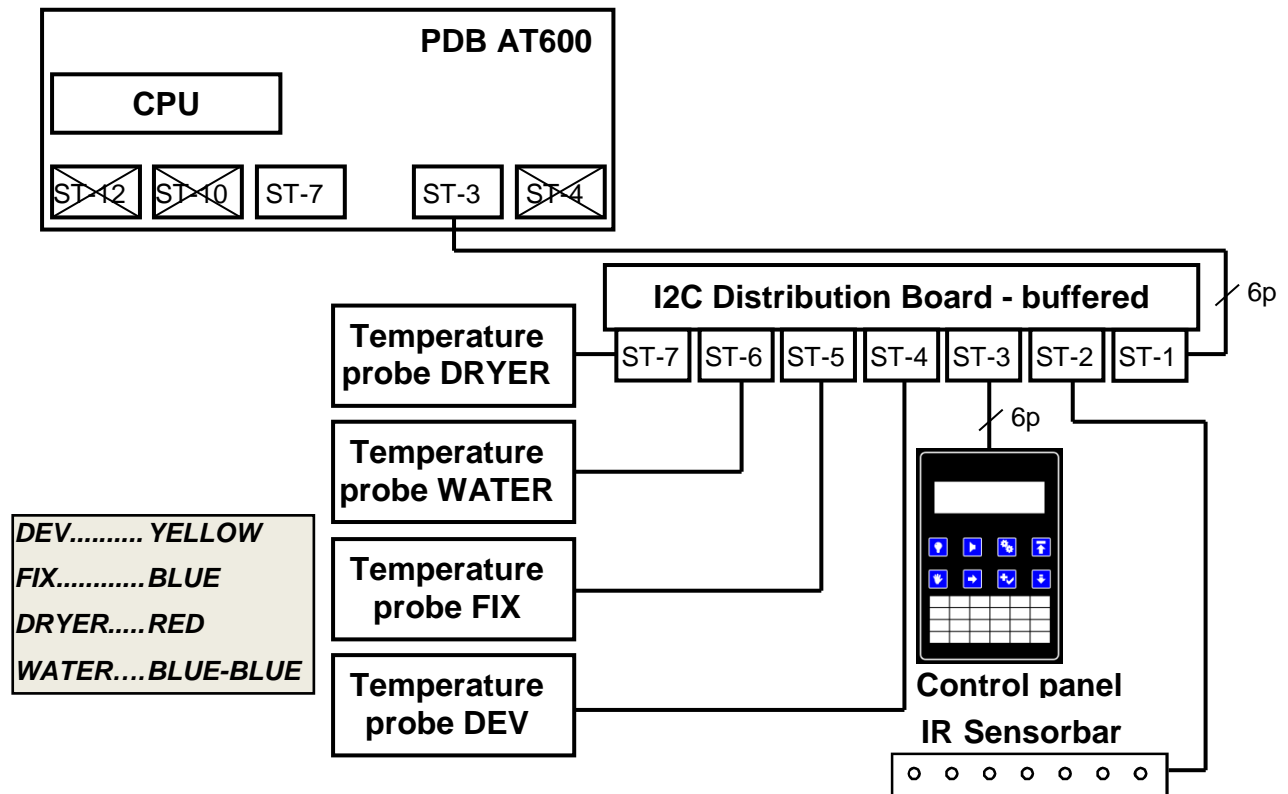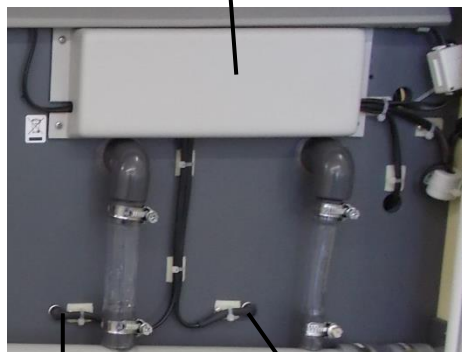

Temp. probe DRYER

I2C Distribution Board

IR Sensorbar

Temp. probe WATER

Temp. probe FIX

Temp. probe DEV

15. **TEST INSTRUCTION FOR THE I2C-BUS SYSTEM**

Prior to the test **disconnect all elements** of the I2C-Bus system and follow the necessary working steps:

A) Install the cable between main board PDB (ST-3) and the I2C distribution board (ST-1)
B) Connect the display to the I2C distribution board (ST-3)
C) Connect the temperature sensor DEV to the I2C distribution board (ST-4)
D) Connect the temperature sensor FIX to the I2C distribution board (ST-5)
E) Connect the temperature sensor WATER to the I2C distribution board (ST-6)
F) Connect the temperature sensor DRYER to the I2C distribution board (ST-7)
G) Install the sensorbar to the I2C distribution board (ST-2)

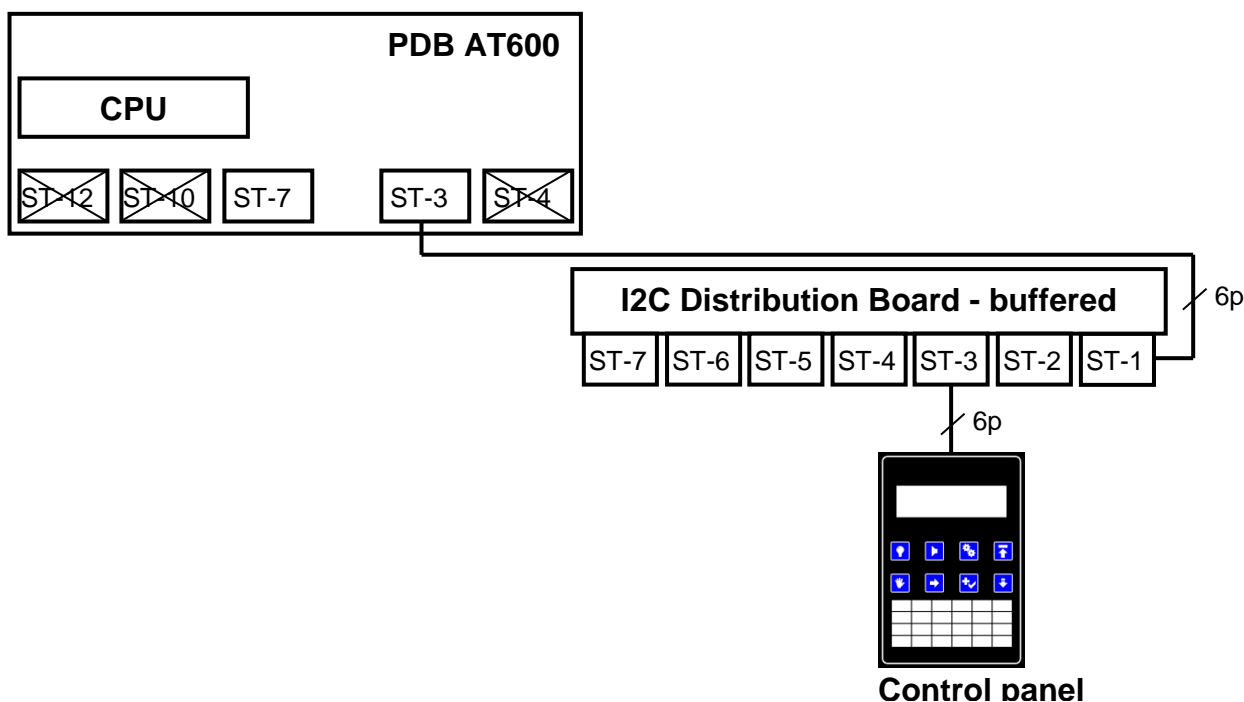## *A) INSTALL A CABLE BETWEEN PDB (ST-3)*

AND THE I2C-BOARD (ST-1)
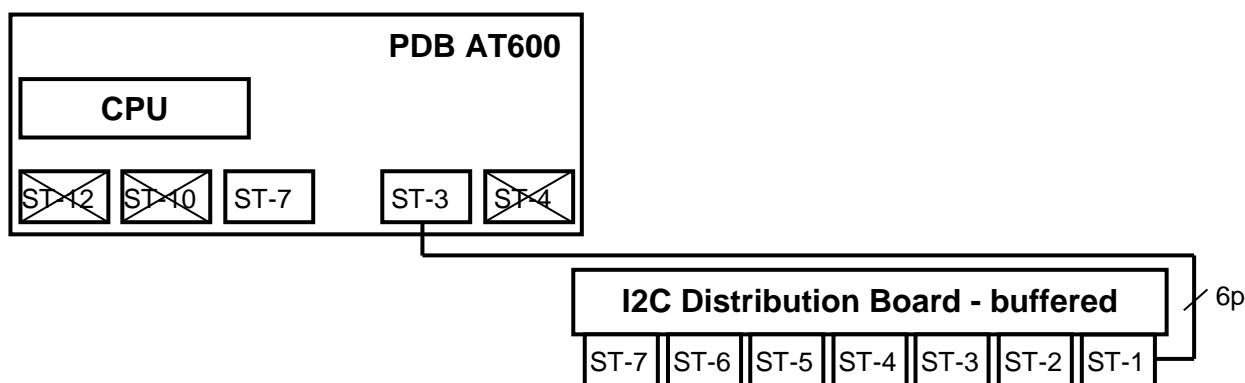
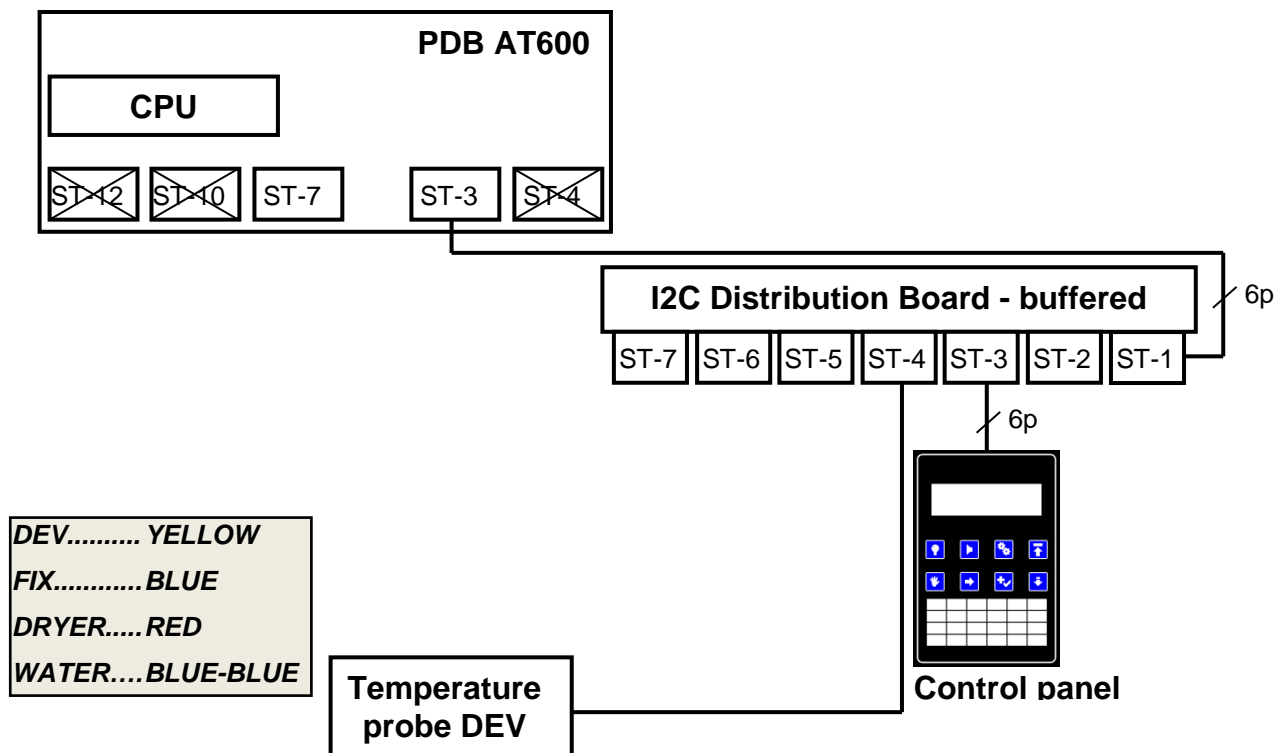## *B) CONNECT THE DISPLAY TO THE I2C DISTRIBUTION BOARD (ST-3)*

If no trouble is shown, the connection cable + the distribution board will be O.K.
If it's O.K. it will show the software identification and the electronic will enter operation mode.
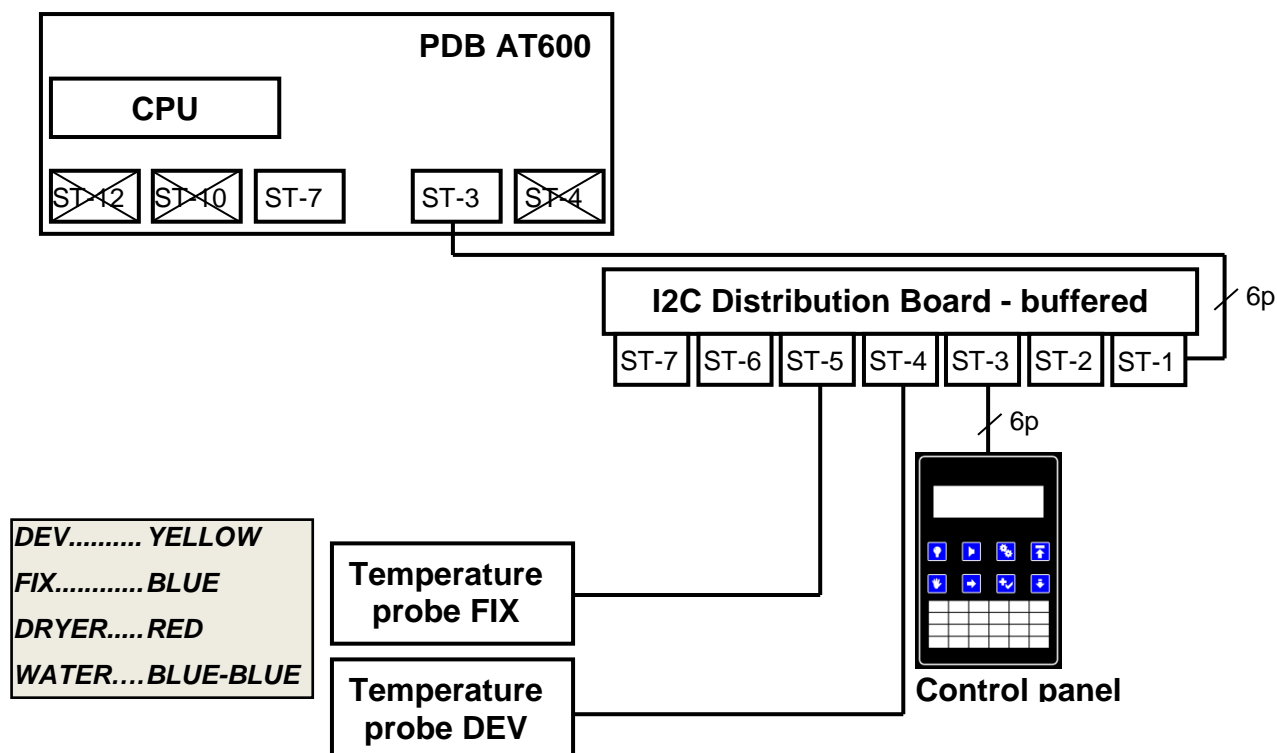

Control panel

C) CONNECT THE DEVELOPER SENSOR TO THE I2C-BOARD (ST-4)

Press ↓ to see T2 (FIX) and T3 (DRYER). If no trouble is shown, the sensor is be O.K.
The display will show the actual measured temperature +/- 1 °C.
If "???" or some other indefinable signs are shown the temperature sensor is defective!

PDB AT600

CPU

ST-12 ST-10 ST-7   ST-3 ST-4

I2C Distribution Board - buffered   6p

ST-7 ST-6 ST-5 ST-4 ST-3 ST-2 ST-1   6p

DEV.......... YELLOW
FIX............BLUE
DRYER.....RED
WATER....BLUE-BLUE

Temperature probe DEV

Control panel

D) CONNECT THE FIXER SENSOR TO THE I2C-BOARD (ST-5)

If no trouble is shown, the sensor is O.K.
The display will show the actual measured temperature +/- 1 °C.
If "???" or some other indefinable signs are shown the temperature sensor is defective!

PDB AT600

CPU

ST-12 ST-10 ST-7   ST-3 ST-4

I2C Distribution Board - buffered   6p

ST-7 ST-6 ST-5 ST-4 ST-3 ST-2 ST-1   6p

DEV.......... YELLOW
FIX............BLUE
DRYER.....RED
WATER....BLUE-BLUE

Temperature probe FIX

Temperature probe DEV

Control panel

E) CONNECT THE DRYER SENSOR TO THE I2C DISTRIBUTION BOARD (ST-6)
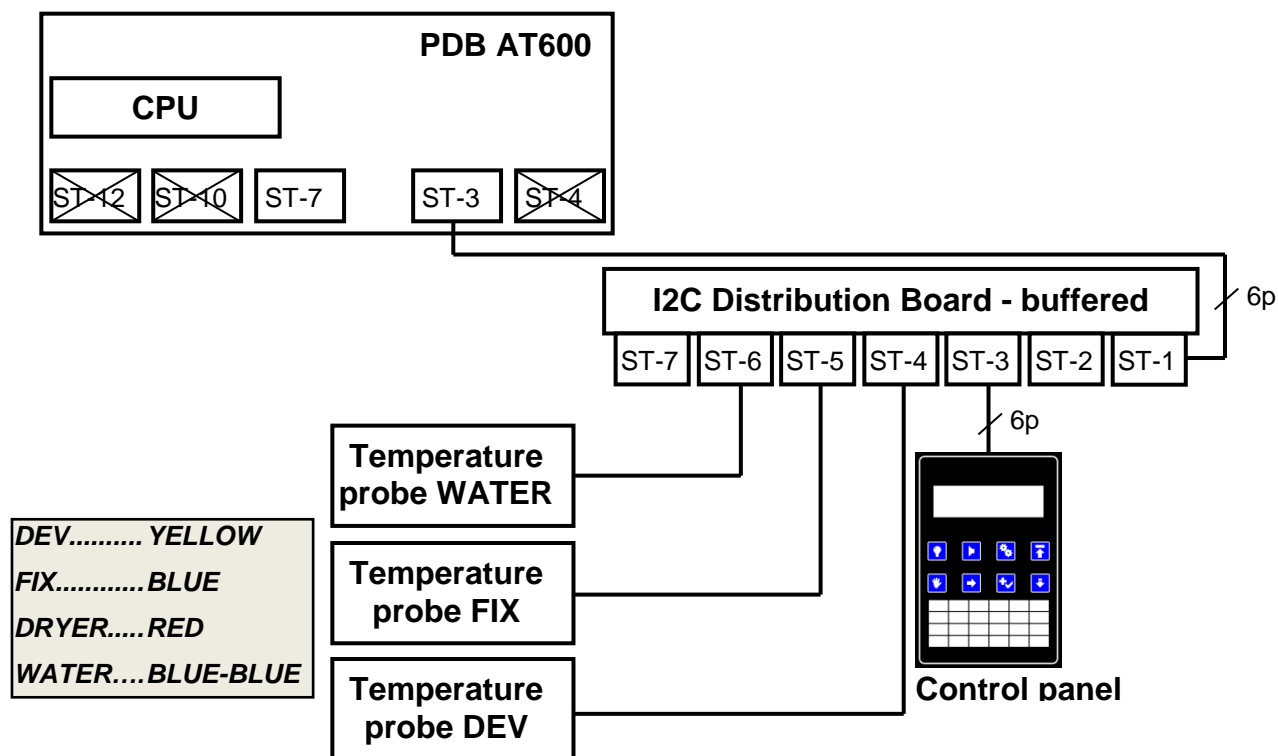
Press 2 x⬇ to see Tw. If no trouble is shown, the sensor is O.K. The display will show the
actual measured temperature +/- 1 °C.
If "???" or some other indefinable signs are shown the temperature sensor is defective!

F) CONNECT THE DRYER SENSOR TO THE I2C DISTRIBUTION BOARD (ST-7)

Press ⬇ to see T2 (FIX) and T3 (DRYER)as well. If no trouble is shown, the sensors are O.K.
The display will show the actual measured temperature +/- 1 °C.
If "???" or some other indefinable signs are shown the temperature sensor is defective!
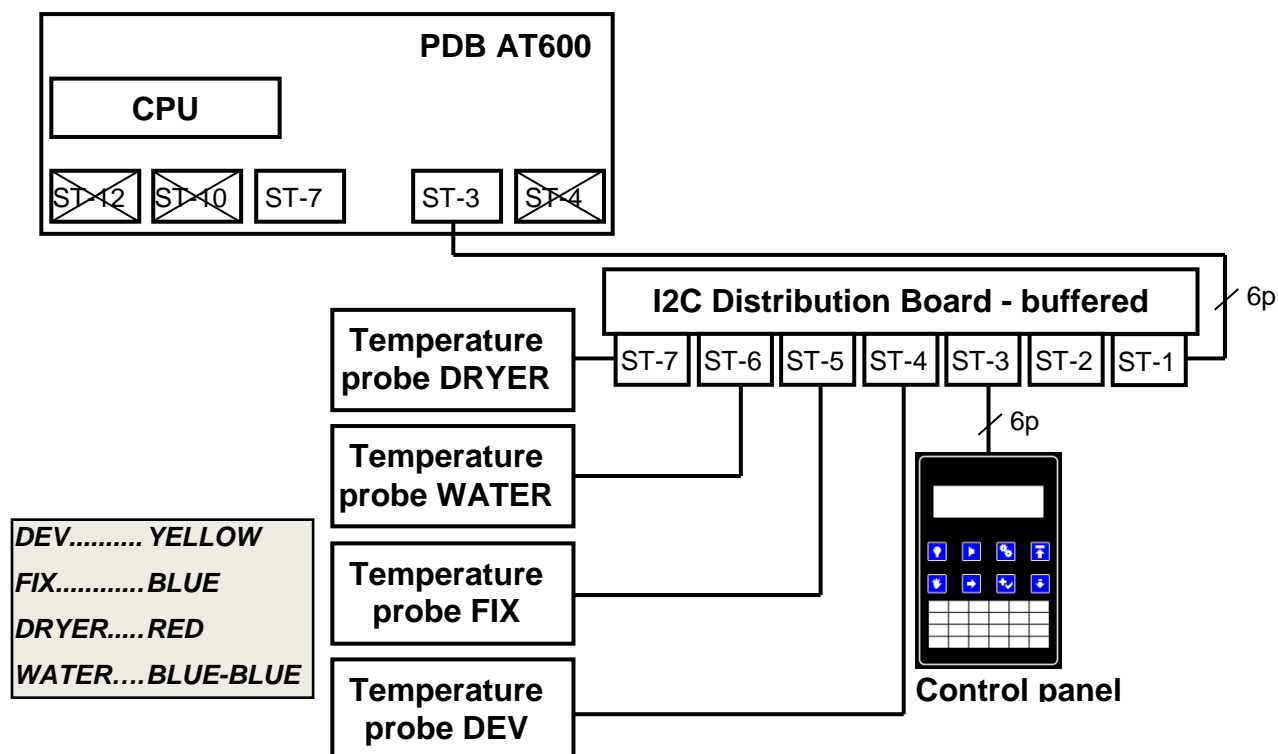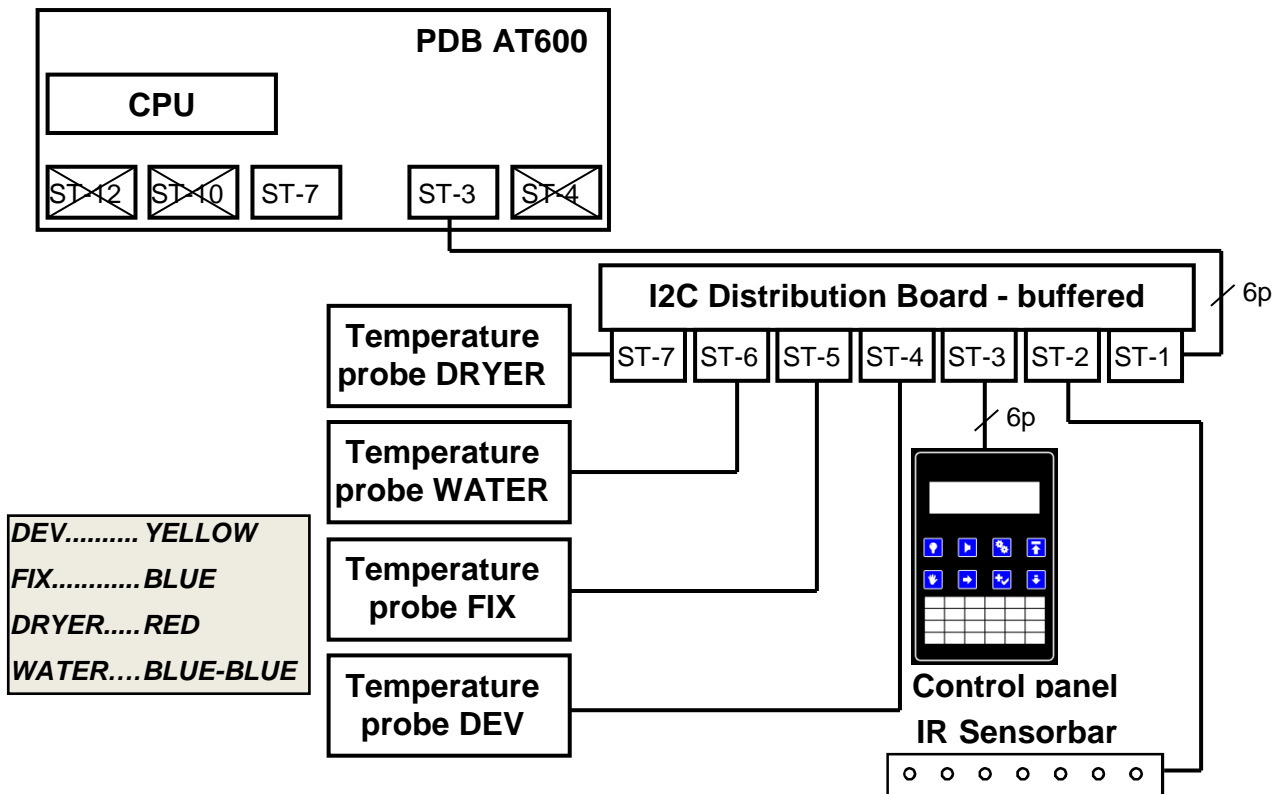
G)   CONNECT THE SENSORBAR TO THE I2C-BOARD (ST-2)

If no trouble is shown, the sensor is O.K. In the "monitor" menu you can verify If all sensors are active

16.   SOFTWARE UPDATE FOR THE PROCESSOR

Of course, the processor is fully tested during the quality control procedure in the factory. Nevertheless, a software update might be required for specific modifications. To do so, a PC is required, supporting the following software:

DANGER:	**Prior to opening Your processor it is mandatory to switch off the main switch and disconnect the power cable to avoid the risk of an electrical shock.**

DANGER

1)   preparations for the service computer .... follow the software installation procedures described in the service CD to install the FLIP software (FLIP = flexible in system programmer) .... only required once!

2)   Make sure the AT90USB diver package is copied onto your PC accordingly (also included in the service CD) .... only required once!

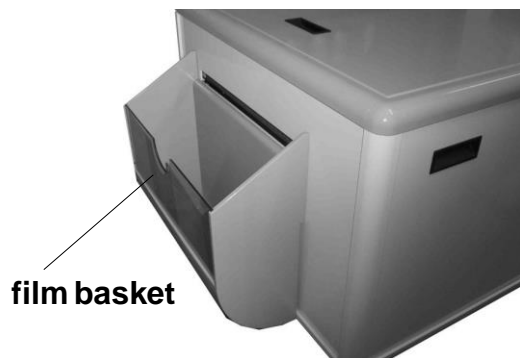3)   switch off the processor and disconnect the 230V main power line !!!

Main switch of the film processor "0" position.

main power line

4)   Remove the film basket and open up the electronic cover lid.
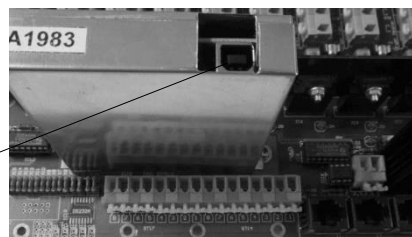
film basket

electronic cover lid.

5)   Disconnect the e-box fan (12V) and the ground connection from the electronic cover lid, and remove the cover for easier access.

Software update for the processor

6) Connect the supplied USB connection cable to the CPU as shown on the picture - do NOT connect the cable to the PC at the moment.

USB CPU connector

> **DANGER:** **Make sure, nobody is able to access the box and the area around you!!**

DANGER

7) Reconnect the processor to the power line and switch it on.

Main switch of the film processor "1" position.

main power line

> **DANGER:** **please be aware that at this point, high voltage is present inside the electronic box - protect your self and others!!!!**

DANGER

6) Connect the other end of the USB connection cable to the PC already in operation.
7) Follow the guide line "USB Firmware update FLIP.pdf" also included on the service CD
8) After successfully reloading the new software switch off the processor, disconnect the 230V power supply of the unit and remove the USB cable.
9) Switch on the processor and compare all processor parameters according to the new factory data using the processor display.
   Make sure all values are the same as shown in the factory datasheet, if not, correct them using the display accordingly.
   NOTE: the setup bridge might be required for this .... see previous chapters
10) Switch off and disconnect the processor the 230V main power supply!
11) Reassemble the unit in the reversed sequence (point 5, 4 & 3) make sure the ground connection and fan connector are back in place and connected!!

17. **TROUBLE SHOOTING**

Problem	Possible cause	Correction
1. Tank1 too cold. The developer temperature is more than 1 °C below the programmed value.	a) Developer bath temperature is too low.	a) Check the heat up time, check the developer temperature for 1°C increase of temperature every 2-3 minutes.
	b) Heater problem.	b) Check in the monitor mode H1, check the LD3 on main board and check the fuse F3.
	c) No circulation in the bath.	c) Check the circulation pump, check the LD7 on main board and check the fuse F7.
2. Tank1 too warm. The developer temperature is more than 1 °C above the programmed value.	a) Chiller doesn't work.	a) Check the cooling assembly, check the LD9 on main board and check the fuse F9.
	b) Cooling pump.	b) Check the cooling circulation pump.
	c) Too little cooling fluid.	c) Check the fill level of the cooling fluid using the inspection glass.
3. Tank2 too cold. The fixer temperature is more than 1 °C below the programmed value.	See point 1.	See point 1, Check the fuse F4 / LD4 Check the fuse F7 / LD7
4. Tank2 too warm. The fixer temperature is more than 1 °C above the programmed value.	See point 2.	See point 2, Check the fuse F9 / LD9
5. Dryer to warm. The dryer temperature is more than 5 °C above the programmed value.	a) Set temperature is too low. (lower than room temperature)	a) Change the set temperature.
	b) Main board defective.	b) Change main board.
	c) Solid state.	c) Solid state relay defective.
6. Motor overload. The drive motor did not reach, it's Set-speed.	a) Main drive assembly blocked.	a) Check the main drive for easy running.
	b) Main drive chain to much tension.	b) Check the chain.
	c) Film jam in the racks.	c) Check the racks.
7. Emergency Stop	a) The cover of the machine is not closed correctly.	a) Check the machine cover.
	b) The cover switch is damaged.	b) Check function of the cover switch.
	c) An emergency stop is active.	c) Check the e-stop if depressed.
	d) The safety relay is defective.	d) Check the relay function.

Problem	Possible Cause	Correction
8. Main drive and dryer run continuously.	a) Main drive was started in "manual mode".	a) Check in the manual program if "STOP" is shown; stop the transport with the button. CAUTION: If also an automatic cycle is started by the sensor bar this cycle will end first.
	b) Material always under the sensorbar. Material not transported/pulled into the processor.	b) Check the input rubber roller, check if a film is on the film table under the sensorbar.
	c) Sensor/s at the sensorbar is/are wet or dirty.	c) Clean the sensor/s.
	d) Main board defective.	d) Change the main board.
9. Material wet when exiting processor.	a) Dryer temperature is too low.	a) Increase the dryer temperature (max. 60 °C).
	b) Transport speed to high.	b) Lower the transport speed.
	c) Unusable or wrong developer or fixer.	c) Increase the replenishment rate or change the chemicals.
	d) Dryer blows cold air only.	d) Fuse "F1" of the dryer heater, solid state relay or dryer heating elements defective. Thermo-switch of the heating element is open.
10. Temperature problems. Temperature is shown incorrectly.	The temperature probes have to be positioned according to their code.	a) The temperature probes are color coded. Developer ... Yellow Fixer ... Blue Dryer ... Red
11. No fresh water supply.	a) Water tap is closed.	a) Open the water tap.
	b) Water valve is blocked or faulty.	b) Clean the small filter in the valve, or replace it.
	c) Main board defective.	c) Check the fuse F8 / LD8.
12. Circulation pump doesn't work.	a) Pump wheel is blocked by dirt.	a) Clean the pump wheel and ensure easy running.
	b) No electrical power.	b) Check the fuse F7 / LD7.
13. Level in water tank to high, water tank overflows.	a) Water drain/overflow blocked.	a) Clean the water tank and clean the overflow and the water drain.
	b) Waste water drain installation.	b) Modify the water drain installation.

Problem	Possible Cause	Correction
14. Level in developer- or Fixer tank too low.	a) Tank leaks.	a) Seal the tank leak.
	b) Too low replenishment rate or too long anti-oxidation cycle.	b) Increase the replenishment rate or decrease the anti-oxidation cycle time.
	c) Replenishment container empty.	c) Fill up the replenishment containers.
	d) No electrical power on the replenishment pumps.	d) Check the fuse F5 / F6, check the LED LD5 and LD6 and clean the replenishment pump or replace it.
15. Chemical temperature can't be reached.	a) Incorrect temperature.	a) Program the temperature correctly.
	b) Temperature sensor is faulty.	b) Replace the temperature sensor.
	c) The processor was started without liquid in tanks. The safety fuses at the heating element have interrupted the current supply.	c) Reset the safety fuse.
	d) PDB is faulty	d) Replace PDB.
16. Scratches or pressure marks.	a) Unsuitable handling of the processing materials.	a) Handle material carefully.
	b) Cross over rollers are dirty.	b) Clean all rollers above the fluid level.
	c) Bent guide bars.	c) Clean and check guide bars. If necessary, replace them.
17. Material remains in the processor.	a) Material fed incorrectly.	a) The material must be fed in straight.
	b) Material has excessive curl.	b) Fold leading edges and feed into the processor.
	c) Material is too thin.	c) Use a leader to process.
	d) Rollers are not rotating.	d) Check gears and the position of the loose rollers.
18. Processor could not be switched on.	a) Main cable isn't plugged in.	a) Plug in main cable correctly.
	b) Main fuse is faulty.	b) Check the main fuse F1.
19. Paper or film too dark.	a) Developer temperature is too high.	a) Decrease the developer temperature.
	b) Processing time is too slow.	b) Increase the processing time.
	c) Exposure time is too long.	c) Reduce exposure time.
	d) After new chemicals: starter is missing.	d) Add starter according to instructions.

Problem	*Possible Cause*	*Correction*
20. Paper or film is too light.	a) Bath temp is too low.	a) Adapt the bath temperature to the recommended process or change chemicals.
	b) Transport speed is too high.	b) Decrease transport speed.
	c) Exposure time is too short.	c) Increase exposure time.
	d) Bath level is too deep. (no heating and circulation)	d) Fill bath to the right level and check replenishment-tanks.
	e) Developer exhausted.	e) Replenish or change chemicals.
	f) Fixer getting into developer. (Dev becomes cloudy)	f) Carefully clean the tank and replace chemicals.
	g) Exposure settings are incorrect or machine is faulty.	g) Adjust setting or repair faults.
21. Paper or film is fogged.	a) Light leak in dark room or cassette.	a) Seal off light leak.
	b) Incorrect dark room light.	b) Check the filter, wattage and distance between the dark room lamp and the processor.
	c) Material is outdated.	c) Check the date of maturity.
22. Paper or film has yellow-green surface.	a) Unsuitable hand processing material is used.	a) Only use material suitable for roller processing.
	b) Fixer is exhausted.	b) Replenish or change chemicals.
	c) Level of fixer bath has dropped. (Temperature safety fuse has been activated)	c) Check level of the replenishment containers and fill up the bath to the required level.
	d) Circulation pumps have failed.	d) Check the pump motor and eventually replace it.

APPENDIX 1 - ELECTRICAL FACTORY DATASHEET

APPENDIX 2 - DEFAULT FACTORY SETTINGS

APPENDIX 3 - ELECTRICAL WIRING DIAGRAMS

APPENDIX 4 - ATMEL FLIP INSTALLATION PROCEDURE

APPENDIX 5 - AT90USB DRIVER INSTALLATION

APPENDIX 6 - FIRMEWARE UPDATE PROCEDURE

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