Chapter 2.01

Msink1 - PR Strip & Pre-Furnace Metal Clean Sink

(msink1) ***(382)***

1.0 Equipment Purpose

1.1 Msink1 provides heated 1165 photoresist strip baths and a SVC-14 pre-furnace metal clean bath for cleaning metal layers (see section 2 for what metals are allowed at this sink). There is also one DI water quick dump rinse (QDR) available in this sink, an organic waste disposal bottle, and a recessed sink-top area that can accommodate chill plates in conjunction with small developer dishes used for special application resist/developers (i.e. N-50 developer used for ZEP-520 e-beam resist). See Figure 1 for sink layout.

2.0 Material Controls & Compatibility

2.1 The following metals are allowed at this sink: Al, Ti, W, V, Hf, Zr, Mo, Ta, Sn, Nb, Ru. Consult with process staff if you wish to use other metals. DO NOT USE THEM without permission.

2.1.1 Other metals may be cleaned at msink2. Once you use msink2, there are many restrictions for where your wafer may proceed to.

2.1.2 Highly mobile ions are not allowed at msink1. The following are explicitly prohibited at msink1: Au, Ag, K, Na.

2.2 This sink is for solvent and developer work.

2.2.1 Developers with a low concentration (2-3%) of TMAH are allowed at this sink.

2.2.2 Highly concentrated (25%) TMAH (Tetramethylammonium hydroxide) is strictly prohibited at msink1, 2, and 3. TMAH work should only be used at msink4.

2.2.3 Water miscible solvents and developers may be disposed using the aspirator. Organic waste and water immiscible solvents must be disposed of using the organic waste bottle.

2.3 Acids, including etchants and hydrogen peroxide (H_2O_2), are strictly prohibited at msink1, and at all NanoLab sinks fabricated from stainless steel.

2.3.1 Some acids and ferrous metals are incompatible, resulting in corrosion and rusting of metal surfaces.

2.3.2 Acid use and electroplating is restricted to NanoLab sinks made of chemically-resistant and fire retardant white polypropylene.

2.4 Liftoff processes, electroplating, cool grease, and crystal bond are not permitted at this sink and in any of the heated baths.

2.5 Wafers that have gone through a UV Bake (such as axcelis) are not allowed in the communal 1165 baths. Oven or hot plate hard baked photoresist is allowed in the 1165 bath.

2.6 No photoresist stripping is permitted in the SVC-14 bath.

2.7 Only the cassettes and handles intended for this sink are allowed here. They are all scribed, and described in later sections. If you cannot find your cassette, you may not borrow from another sink.

3.0 Training and Applicable Documents

3.1 Exam Tool

3.1.1 This tool requires an online exam before qualification.

3.1.2 Timeline (estimated time to completion: 1 week)

3.1.2.1 Get trained by any qualified member.

3.1.2.2 Take the online test in the Nanolab office (open 8A-12P, 1P-5P). The msinks 1, 2, and 3 tests are combined together.

3.1.2.3 Arrange a qualification session with a superuser to show competency on the tool. The msinks 1, 2, and 3 tests are combined together for qualification - please be familiar with all the sinks when you arrange a qualification session.

3.1.2.4 Note that sinkclass is a prerequisite for qualification on all sinks.

3.1.3 Superusers and staff qualify members on this tool.

3.2 Chapter 2.01 - Sink Summary

3.3 Process Chapter 2.1 - Chemical/Labwear Guidelines

3.4 Process Chapter 2.5 - Photoresist Stripping provides significant additional processing details

4.0 Definitions & Process Terminology

4.1 Quick dump rinse (QDR): DI water fills the sink followed by a quick dump to get rid of excess acid and/or contaminants. Resistivity must be >10 Mega ohm-cm for this step to be complete.

4.2 Spin Rinse Dryer (SRD): DI rinse followed by dry cycle.

4.3 Tank: These are available to do large batches of chemical processing but cannot be heated up; available for room temperature only.

4.4 Bath: These are available for heated batch chemical work.

4.5 Exhaust alarm: This alarm shuts off power to the sink when the sink exhaust falls level falls below a certain limit (currently set at 0.8 inches of water; full scale is 1).

4.6 DI: De-ionized water used for clean processes with a resistivity of ~18 Mega Ohm-cm.

4.7 IPA: 2-propanol, or isopropyl alcohol. Available at certain sinks and around the lab in yellow-topped squeeze bottles.

5.0 Safety

5.1 Follow general safety guidelines for the lab; the safety rules outlined in Chapter 1.01 - Marvell NanoLab Chemical Hygiene Plan and the following:

5.2 The following ***Personal Protective Equipment (PPE)*** must be worn at all times while operating this sink:

5.2.1 Chemical-resistant apron, face shield, and chemical-resistant gloves (either tan tripolymer multi-use or green single use ones) (chem) gloves.

5.2.2 Tan chem gloves can be purchased at the Nanolab Office (open 8A-12P, 1P-5P). During off hours, you may checkout gloves from the plastic box in the gowning room.

Please only do this if the office is closed, or the supply may not last through the weekend. Green gloves are available near sinks throughout the lab.

5.2.3 Chem gloves must always be the last thing on, and first thing off, so you do not accidentally leave residue chemical anywhere that another lab member may touch without proper safety gear (i.e. phones, doorknobs, table tops, etc.).

5.2.4 Chem gloves should be inspected for holes before each use, and multi-use gloves replaced regularly even if they appear to be in acceptable condition.

5.2.5 Lab members may purchase their own chemical aprons and faceshields. These can be stored in ziploc bags on the designated storage areas of the gowning room (shelves 12-4 and 12-5) or the metal rack in 391.

5.3 Closest Safety Showers are located in bays 383 and 385 near the windows.

5.4 This sink contains heated 1165 and SVC-14 PR strippers with flash points specified in the material data sheet. Do not adjust the heater controllers as they have been preset to produce proper temperatures for these chemical solutions currently at 80 ºC.

5.4.1 Changing the temperature is potentially a fire hazard due to the flash point of these chemicals.

5.5 Do not drain the heated baths. This is a staff-only job, and these chemicals must not go down the drain. Instead, they are collected in carboys and sent to EH&S for safe processing.

5.5.1 If issues arise with one of these baths, ask staff to evaluate and replenish the chemicals if deemed necessary.

5.6 Only use the white Teflon® 25-slot chemically resistant cassettes with locking handles. Please do a “shake test” after loading your wafers to make sure that you attached the handle correctly. Do not use these at any other sink.

5.7 **EPO** red button: Cuts power to the sink in emergencies. Report promptly on as problem on Mercury Client.

5.8 The de-ionized (DI) water deck hose for the sinks is **ALWAYS** available for emergencies; it provides a good safety backup in the event of exposure to chemicals.

5.9 **No hot plates** to heat any solvent or soft baking photoresist and/or curing of polymers are allowed at this sink. Use bake oven/hot plates in this bay for such purposes. Only chill plates are allowed, and at the recessed area of the sink, e.g. Crestec users.

5.10 **No acid** allowed at this sink.

5.11 Use of 25% TMAH is prohibited at msink1/2/3, and should only be used at msink4.

5.12 Dwyer Photohelic Exhaust Flow Meter: Monitors the sink exhaust flow and will shut down all electricity and water to the sink if there is too much or too little flow. An alarm will sound; press the “silence” button and attempt to power back on. If continued alarm, promptly report as a Fault on Mercury.

5.13 Msink1 has an integrated fire suppression system which is tied to the lab and building-wide fire alarm system. Activation of the fire suppression system releases large volumes of CO2 directly at the heated baths and deck area of the sink. Activation of the fire suppression system will also initiate the lab and building-wide fire alarm system. Immediately evacuate the lab after activation of the Msink1 integrated fire suppression system and notify others around you to do so as well.

5.14 Always leave a process ID tag on on-going work indicating your name, membername, date, time, and chemical (even if it's water).

6.0 Process Data

6.1 This tool has not been characterized by staff

7.0 Available Processes

This sink contains 3 heated baths (short soak 1165 remover, long soak 1165 remover, and SVC-14 metal clean). Additionally, there is a limited amount of deck space for beaker work, a chill plate, two ambient baths, and an organic waste collection bottle.

Bath	Chemical	Time	Temperature
Left Heated Bath	Pre-Furnace Clean	10 min.	80℃
Center Heated Bath	1165 (Short Soak)	5 to 20 min.	80℃
Right Heated Bath	1165 (Long Soak)	20 min. to 8 hours	80℃
Front Ambient Bath	Developer Solution	Any	~20℃
Rear Ambient Bath	Developer Solution	Any	~20℃

7.1 You must enable msink1/2/3 when working at the sink at all times, and disable when you are done. If another person is working at the sink, please communicate with them before disabling.

7.2 1165 remover baths:
http://microchem.com/products/images/uploads/Remover-1165-DataSheet-RH.pdf

7.2.1 There are two 1165 remover baths. The short soak is generally for bath times under 20 minutes, and the long soak is for 20 minutes - 8 hours. If you need longer than this, please consult with process staff.

7.2.2 Use the white Teflon cassettes and handles in the bin to the side of the sink. They can be scribed any of the following: "msink1", "PRS 3000-1", or "msink1 1165".

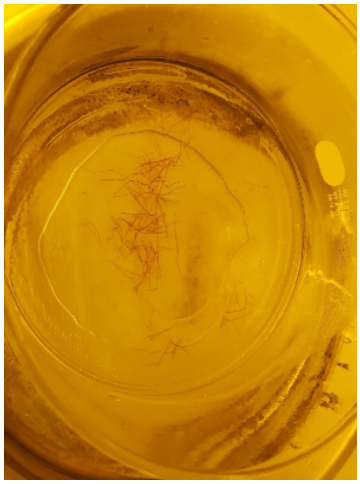
7.2.3 1165 remover is an NMP-based remover, excellent for removing many kinds of photoresists.

7.2.4 The baths are set to 80°C. Lab members may never change the temperature.

7.2.5 After placing your wafers in the 1165 for the desired amount of time, they should then go in the QDR followed by the SRD (section 8). They can remain in the same cassette the entire time, though the handle gets removed after the QDR step.

7.2.5.1 Please note the chemical height with respect to the QDR height on the cassettes and handles. If the chemical height is higher, rinse the excess with the deck hose for 2 minutes.

7.2.6 Wafers that have gone through a UV Bake step (such as axcelis) are not allowed in these baths. These have been shown to cause photoresist "stringers" in the bath. To remove photoresist that has gone through a UV bake step, you may either use a beaker of 1165 or matrix.



7.3 SVC-14 metal clean:

7.3.1 This is a pre-furnace metal clean step for refractory metals. The following metals are allowed: Al, Ti, W, V, Hf, Zr, Mo, Ta, Sn, Nb, Ru. Consult with process staff if you wish to use other metals. DO NOT USE THEM without permission.

7.3.2 Since this is a pre-furnace clean, you also must wear polyethylene (“poly”) gloves during this process, in addition to all safety gear.

7.3.3 The bath is set to 80°C. Lab members may never change the temperature.

7.3.4 Msink1 SVC-14 cassettes are stored on top of msink1 in a yellow bin and are labeled "SVC-14". After the SVC-14 step, they can stay in the same cassette for QDR and SRD steps (Section 8).

7.3.5 After the clean is done, they may be transferred to the furnace using the “SVC-14 Metal Clean Transfer Box” located on top of the sink. Please note that these boxes are for transfer only, not for storage.

7.4 Beaker work:

7.4.1 The chemicals stored under the sink are available for beaker level work. If you cannot find your chemical under msink1, you may look under msink2 and msink3 - all chemicals at these sinks are available for use at any sink.

7.4.1.1 The following chemicals are kept under msink1/2/3: SVC-14, 1165 remover, acetone, IPA, methanol, n-amyl acetate, PCS 605, PRS-3000, SU-8 developer, AZ 400K (1:4), MIBK/IPA, OCG 934, OPD 4262, and MF-26A

7.4.2 You must always finish a bottle before starting a new one, and you must always wash a finished bottles (Section 8.3).

7.4.2.1 NEVER leave empty bottles or multiple started bottles at the sink.

7.4.3 If all bottles of your chemical are used up under msink1/2/3, please see the following locations for backup stock. Use a bottle carrier to carry the bottle to the sinks, and store partially used bottles under the sink.

7.4.3.1 381-C2: This cabinet has SVC-14, 1165 remover, acetone, PRS-3000, SU-8 developer, AZ400K (1:4), MIBK/IPA, OCG 934, OPD 4262, and MF-26A.

7.4.3.2 CPD sink: Under the CPD sink in 382 is backup IPA and methanol

7.5 **Special Chemicals:** While the NanoLab supplies many chemicals for lab members to use, there may be some for your project that are not stocked. In this case, you may bring in these special

chemicals by following the procedure outlined in the Chemical Hygiene Plan, section 5.1, namely the following steps:

7.5.1 Before bringing in a special chemical, you must have approval from the NanoLab safety officer or process staff.

7.5.2 All special chemicals must have a label printed in the NanoLab that defines where the chemical is stored and how it is disposed of.

7.6 **WARNING**: The use of acids, acid etchants, hydrogen peroxide (H2O2), and plating baths is strictly prohibited for NanoLab sinks fabricated of stainless steel.

7.7 Use of 25% TMAH is prohibited at msink1/2/3, and should only be used at msink4.

7.8 Soft baking of photoresist and other use of hot plates are not allowed at this sink.

7.9 Liftoff processes are not allowed at this sinks in any of the heated baths (SVC-14 metal clean and the 1165 photoresist strippers). These should be done in the ASAP Liftoff tool or in msink16 or Msink18 instead.

7.10 If your wafer box has only seen wafers that would be compatible at msink1, then you may use the msink1 QDR to rinse it out to clean it from particulates.

7.11 An orbital shaker is available for use for help developing SU-8 resists. It is stored in 382 under the hotplates. It can be used on the right side of msink1, and should be returned to it's storage spot when you are finished using it.

8.0 Sink Operation

8.1 Waste Disposal

8.1.1 Water miscible solvents and bases may be aspirated. This includes the following:

8.1.1.1 Acetone and IPA *without* photoresist mixed in

8.1.2 Water immiscible solvents and organic waste must be disposed of in the organic waste bottle, including the following chemicals. Please note that the pink lid of the funnel must be OPEN before pouring.

8.1.2.1 Any form of photoresist besides LOR, including acetone or IPA mixed with photoresist

8.1.2.2 Water immiscible solvents such as 1165 remover and PRS-3000

8.1.2.3 Certain developers, including SU-8 developer and MIBK.

8.1.3 LOR waste is disposed of in a separate container from other organic waste, because the mixing of LOR and acetone can cause the LOR to harden and clog the organic waste funnels. A gallon wide-mouth bottle for LOR waste only is stored at msink3 with a separate log sheet, that is mounted to the outside of msink3 near the headway2.

8.2 **To change organic waste bottle:** When a bottle reaches or almost reaches the blue line (becomes 80% full), you are responsible for changing it to an empty one. Do not leave a full bottle for the next person to change. Bring a new (empty) bottle from 391-C1 to msink1/3. Swap that bottle's cap onto the full bottle, and put the funnel onto the new bottle. Fold the filled out organic waste manifest into the full bottle. Write the number from the new bottle onto the next sheet on the clipboard. Take the full bottle to 391-C2.

8.3 **To rinse empty bottle in bottle wash:** Carry the empty bottle to the bottlewash in 397 using a secondary containment carrier. Wear the safety gear supplied there. Take off the cap to the empty bottle, and place the bottle upside down on the water spout. Close the lid. Press the green button which cycles water for one minute. Draw an X on the label, and place in the blue recycle bin

(either glass or plastic).

8.4 Control Panel

8.4.1 The buttons along the front panel are used to control the EPO, power on, power off, alarm silence and alarm reset functions of the sink (see Figure 3). The following describes their use.

8.4.2 Press PUMP OFF/ON button to enable/disable aspirator operation for 3 minutes,which also activates the plenum. The container or beaker which holds chemical is drained by using the aspirator. Before aspirating any solution, rinse off the aspirator tip with the deck hose to avoid contamination. Water-soluble solvents such as methanol and isopropanol can be aspirated.

8.4.3 GOOSE NECK OFF/ON: press to enable water flowing through the goose neck into the rinse tank. Water flow will shut off automatically after 3 minutes. Flow strength can be adjusted by turning the valve on the side of the goose neck.

8.4.4 SILENCE: press to silence an alarm.

8.4.5 STATIC BATH DRAIN 1 and 2: switch to drain for manual developer tanks 1 or 2.

8.4.6 Timers are available for both ambient tanks (Figure 5). Use the up/down arrows to set time, press START to run, or STOP/RESET to clear display.

8.5 Quick Dump Rinse and Spin Rinse Dry (QDR/SRD) Operation

8.5.1 Slowly lift the wafers, letting the residual acid drip into the bath. Place into the QDR and run until the resistivity is >10 Mega ohm-cm (about four cycles).

8.5.1.1 If the QDR is empty, hit “stop/reset”, then “start”

8.5.1.2 If the QDR is full, hit “open”, then “stop/reset”, then “start”

8.5.2 Remove the wafers from the QDR. Remove the handle. Place the cassette into the SRD (either 4” or 6”) until resistivity is > 12 Mega ohm -cm. The H-Bar should face in.

8.6 Hot Bath Controller Operation

8.6.1 Draining Chemicals in MSINK1 is handled by process staff only. Control Panel Programs are shown in the Appendix. The parameter codes for the programs on the MPC-100 temperature controllers are listed in Tables 1 and 2. The parameter codes are not to be altered by lab members; please only use them as your reference check.

8.6.2 Msink1 short soak 1165 bath has been modified to include a diaphragm pump, filter, and an “infinity” bath.

8.6.3 The stainless steel bath, which is heated to 80 deg. C, consists of two separate sections: the main bath in the front and the overflow weir in the rear. **Both of these sections need to be filled up to within ½ inch (12mm) of the top of the section separating the two areas before the pump is operated.** This is necessary to properly clear any film off the top of the bath and prevent air from being pumped into the main bath, causing bubbling and spattering of the 1165. Once the proper height is insured, one can then press the green button located on the head-case next to the bath controller, labeled “1165 Pump.” The button will light up and the pump will run for 20 seconds, which should be long enough to clear the top of the bath of any film, by raising the level of the main bath so that it overflows into the rear weir. If the top is not clear of film, you can repeat the pump cycle as many times as necessary.

8.6.4 Place your wafers in the desired bath, either the short soak 1165 bath, for 5 to 20 minutes, or the long soak 1165 bath for 20 minutes to 8 hours, or the metal cleaning bath

for 10 minutes.

8.6.5 Press time/start button to start the strip process cycle with the preset time and temperature (optional) (Figure 4).

8.6.6 When your strip/clean cycle is completed after the preset time, hit the TIME STOP/RESET button to reset the timer alarm.

8.6.7 Remove your wafers and rinse in the quick dump rinse station.

8.6.8 Adding Chemicals in MSINK1: lab members are allowed to add more 1165 to the baths when the **L Level** warning indicator light is on. Bottles are located under the sink.

9.0 Troubleshooting

9.1 Rinse cycle stopped in the middle QDR cycles: press open to dump the water out. Press stop/reset key followed by restart the dump rinse cycle from the start.

9.2 Power to system is off: Press power ON if no issues have been reported on the Mercury or if the system is not under technician's control.

9.3 Photohelic Differential Pressure Reading (Figure 7) is outside defined limits (two red bars): Consult with staff to check house exhaust pressure.

9.4 I can't find the cassette I want. Can I use a cassette for a different bath or sink?

9.4.1 NO! Never. Report the problem.

9.5 I am all out of the chemical that I need. What should I do?

9.5.1 First: Pull out the storage bin. Check if there is another bottle of your chemical in it.

9.5.2 Second: Check the bins under msink2 and msink3 as well. Even if you are only qualified on msink1, you can get a chemical from any of these sinks.

9.5.3 Third: If that chemical is out from all sinks, you may bring a bottle over from the following locations:

9.5.3.1 381-C2: This cabinet has SVC-14, 1165 remover, acetone, PRS-3000, SU-8 developer, AZ 400K (1:4), MIBK/IPA, OCG 934, OPD 4262, and MF-26A

9.5.3.2 CPD sink: Under the CPD sink in 382 is backup IPA and methanol

9.5.4 Fourth: If all of those locations are out of the chemical as well, report the problem on Mercury.

9.6 My labware is wet. Where should I dry it?

9.6.1 **Drystation1:** lab glassware drying station. Place your washed/wet glassware on the tray directly underneath the **"STA-HOT"** infrared lamp. Toggle the **"ON"** switch to the **UP** position. Turn the timer clockwise to 60, then back to the desired time for drying your glassware. When the time is up, wait for 5 minutes for the glassware to cool down. A **"hot hand"** is provided for your safety. Remove your dry glassware and store it away. Make sure your glassware is labeled with your name and/or login. Three trays are provided at this station. If a tray is full, lift and place it on the shelf underneath.

10.0 Study Guide

10.1 To be updated

11.0 Appendices, Figures & Schematics

1. Glassware (and teflon beakers) can be stored in the communal glassware cabinets. On the third floor, this is at the window area between bays 380 and 382, and on the 5th floor it is in 591 near 591-C1. Cabinets must never overflow- the doors must always be able to fully close. Glassware must have a current member's name on it - not a former member or a group name. Otherwise, it may be purged.

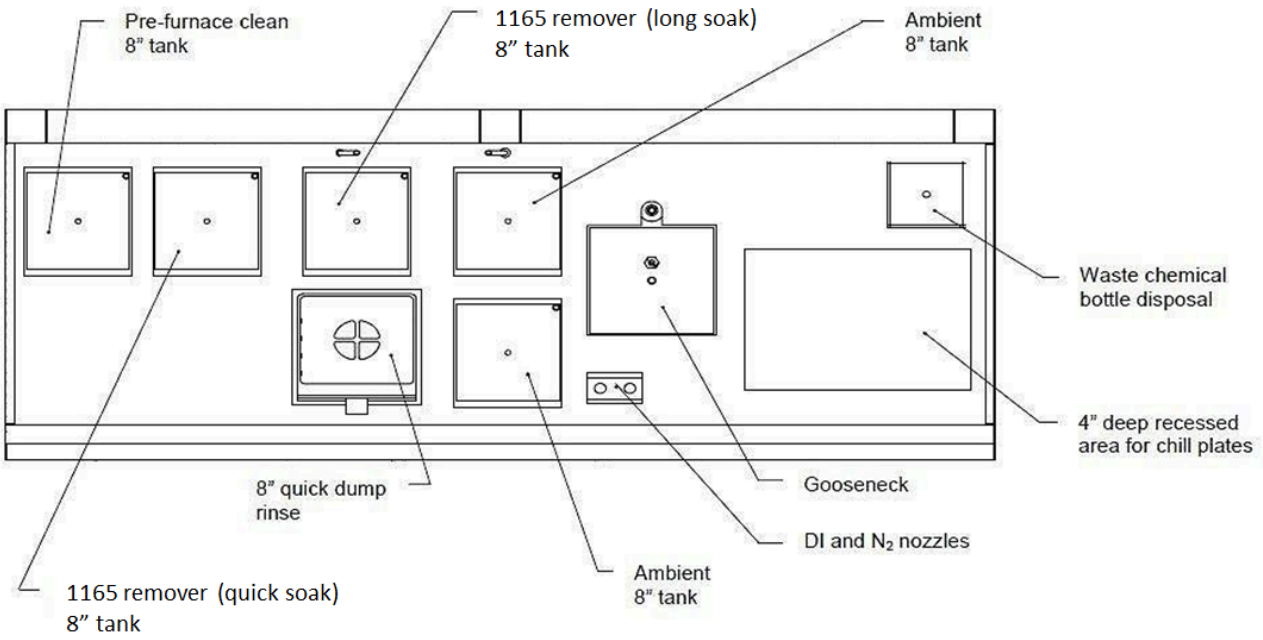


Figure 1 - Msink1 Top View Schematic

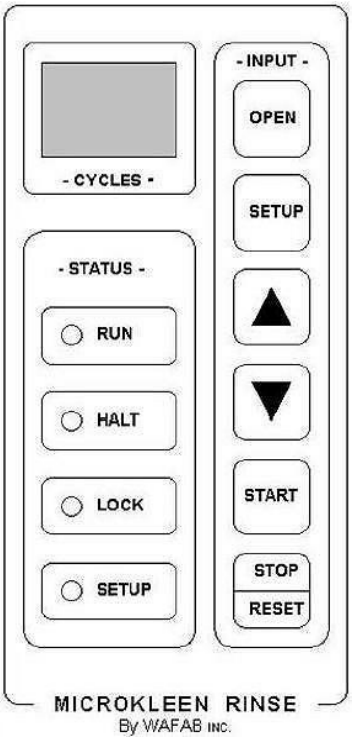


Figure 2 - Quick Dump Rinse (QDR) Controller

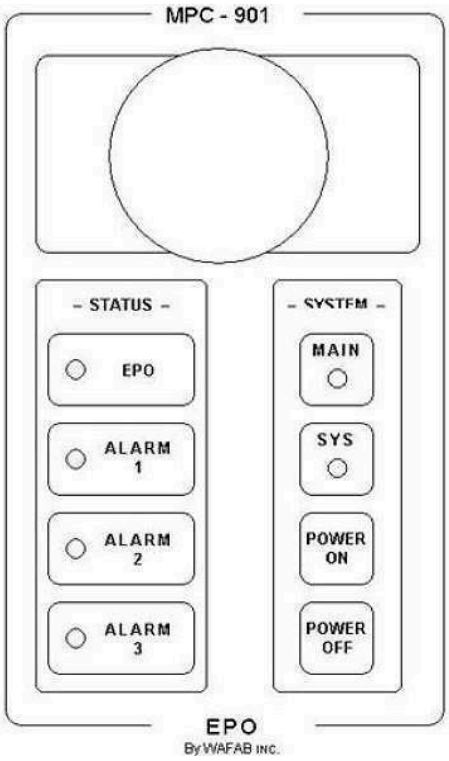


Figure 3 - MPC-901 Emergency Off and Alarm Controller

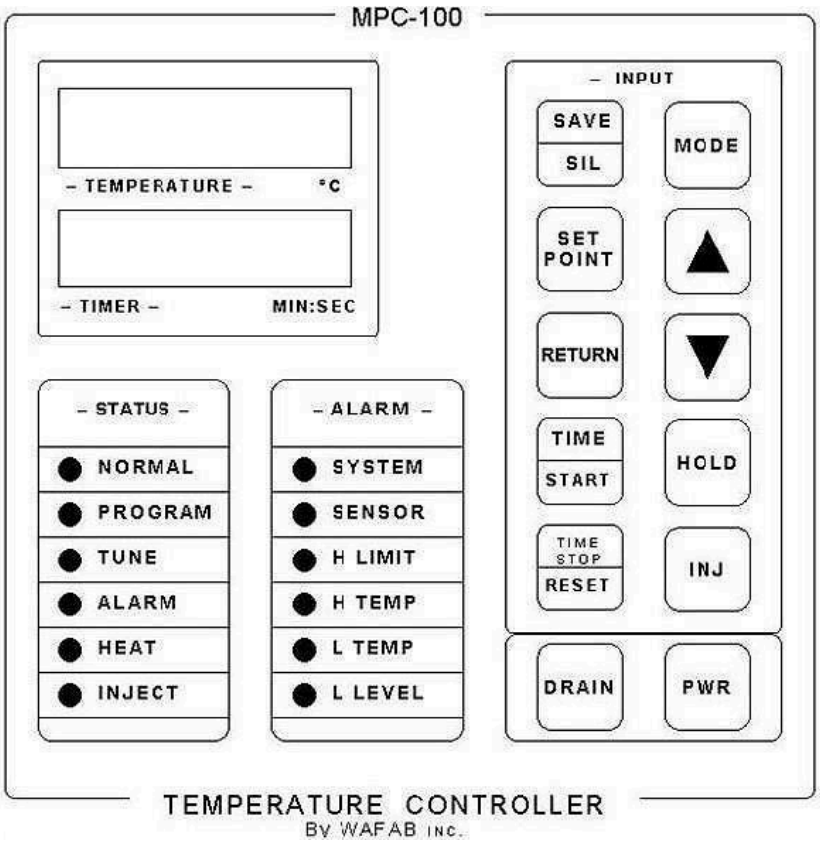


Figure 4 - MPC-100 Hot Bath Temperature Controller

Figure 5 - Ambient Tank Timer

Figure 6 - Resistivity Meter

Figure 7 - Photohelic Gauge

Figure 8 - Mskink1 Teflon® Dedicated Cassette

Temp.	Timer
Cr	10
Pb	1.0
rE	1.0
OF	0.0
AC1	0.0
AC2	0.0
PS	80.0
dr	40.0
dp	10:00
HI	10.0
LO	10.0
CS	30:00
PA	:30
IP	:00
Cd	d1

Table 1 - Msink1 MPC-100 Hot Bath Temperature Controller Codes

Note: Do not change these recipes. The factory set-up codes will be impacted.

Cycles	
CY	2
FP	45
dP	5
Sd	4
Ad	0
n2	n
Ac	0
PC	5
Pn	1
nb	10
SL	1

Table 2 - Msink1 Quick Dump Rinse Codes

1165 or SVC-14 Photoresist Strip Bath draining (PROCESS STAFF ONLY)

1. Press the **HOLD** button once on the MPC-100 temperature controller panel, which turns the heater off. The bath temperature must cool down to 60ºC before draining. Report the problem on Mercury, and put a sign on the control panel, so that members know the bath is being cooled.
2. These chemicals need to get captured through the drain hose at the back of the sink. Make sure the drain hose is securely placed in the designated carboy for PRS-3000 or SVC-14 in the chase 381.

3. Once the chemical is at 60ºC or below, you can start draining the bath by pressing the drain key twice on the MPC-100 controller (“drn” should appear without blinking)
4. Go to the back and open the drain valve at the back of the sink. Watch it drain the chemical. Leave some room in the carboy, as you will also need to rinse out the empty bath.
5. Use the deck hose to rinse out the emptied bath; this also gets drained into the carboy. Be sure not to overfill the carboy!
6. Once done draining and rinsing the bath, close the drain valve in chase 381.
7. On the control panel, press “Drain” again to STOP the draining (it should read “HOLD”). Add new chemical to the desired level.
8. Press the HOLD button to restart the heater. The LED Heat light will turn on and bath temperature will eventually ramp up to 80ºC.
9. Prepare the carboy for EHS pickup if you know how to do this. If not, label it with the chemical contents and contact process staff so it gets prepared for EHS pickup.