Cornell University
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# Karl Suss Gyrset RC-8
# Resist Spinner System
# for
# P-20, KMPR, SU-8, Cyclopentanone,
# Cyclotene
# and
# AP 3000

# User Instruction Manual

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**Process Definition**

- HMDS liquid primer using automatic dispenses
- Hand dispense of SU8, KMPR, SU-8, Cyclopentanone, Cyclotene and AP 3000
- NO LOR, Acetone, IPA, or Methanol.
- Cotton Candy removal, bowl clean, edge bead removal
- Current supported substrate size is 100mm.
- Small pieces can hold vacuum using special gasket.

**Safety Protocol**

- All users need to get CNF staff trained prior to tool usage.
- MSDS for all chemical used need to be reviewed
- Machine Hazards
  - pinch
- Safety start/stop panel

**Tool description**

- Self contained unit
- lower cabinet used for pump storage
- Gyrset 8
- pump controller
  - on top of the machine

**Programming**

- Slots available for programing are 1-8
- Slot 1 is only store one complete step.
- Slot 9 is used for the bowl clean
- Slots 2-8 are able to store multiple steps in different configurations.
- The tool had two modes RUN and EDIT.
- All programs writing can be simplified as FUNTION fallowed by ENTER, followed by the VALUE/SPEC fallowed by ENTER.
- Both Open Bowl and Close Bowl recipes can be written.

**Description:**

| Maximum speed | 5000 rpm (no load) |
|---|---|
| Minimum step | 10 rpm |
| Speed regulation | Tachnometric dynamo associated with motor |
| Speed control | Galvanometric coil |
| Maximum Acceleration with Open Bowl | 7000 rpm/sec (with substrate) |
| Maximum Acceleration with Close Bowl | 5000 rpm/sec |
| Maximum Acceleration while Closing | 200 rpm/sec |
| Minimum Step | 100 rpm/s |
| Time Range | 0 to 999 seconds |
| Time control | Countdown display by LED indicators |
| RS 232 C configuration | 9600 Bauds/ 8 BITS / 1 BIT Stop / No parity |
| Maximum Substrate Size | 8"〇/ 6"☐ (G8), 5"〇/ 4"☐ (G5), 3"〇/ 2"☐ (G3) |
| Maximum Substrate Thickness | G8 = 4mm, G5 = 5mm, G3 = 5mm |
| Power Connection | 115/230 VAC -47-63 Hz 300 VA |
| Air Pressure (Dry Air) | 4 – 9 bar |
| Minimum Vacuum | -0.6 bar |
| Nitrogen | 4 – 9 bar |
| Exhaust | 600 l/min |

The SUSS RC8 is a modular system designed to be adapted to wide range of applications withing the resist coating regime. The Gyrset system are composed of eight elements including the GYRSET system, the protective cover, the collecting bowl, the resin collector, the vacuum chamber, the spinner motor, vapor exhaust and the deflector. These elements created a static solvent saturated atmosphere where the air turbulence is drastically reduced creating an optimal  atmosphere for coating performance which include the reduction of particulates.

**Safety:**

As in the usage of any electro-mechanical machine there a few dangers associated with the tool operation. Understanding the proper operation and the possible dangers will minimize both harm to the user and the to the tool.  Chemical, Mechanical and electrical dangers are possible dangers that will be associated with this tool if improperly used. Also note that we ever the machine is being operated all doors have to be closed or the machine will no work properly.

**Chemical Dangers:**

**Chemistries and Hazards:**
  - RC8 - "SU-8" will be used for hand dispense of irregular resist formulations such as SU-8,, KMPR and other thick resist. The machine will also utilized two solvents for Cotton Candy removal, bowl clean, edge bead removal.
  - Understanding the possible dangers of working with these chemicals and the location of their appropriate HMDS data sheets are necessary.
  - Always remember that for any resist formulation and a CNF pre-approved HMDS data sheet is needed even before the chemical is brought into the building.

- **Solvents:**
  - SU-8 2000 Thinner
  - Cyclopentanone make up 99 percent of the solvent.
  - The chemical is used to remove SU-Thinner
  - This Solvent is a flammable liquid, an irritant both on skin an eyes. It is also harmful to the body if ingested or inhale.
  - National Fire Protection Association Hazard Ratings (NFPA)
    - 2   Health Hazard (Moderate)

- 3   Flammability (Serious)
- 0   Instability (Minimal)
- 

**Photoresist:**
- KMPR
- SU-8 2000
- SU-8 3000
- AP 3000
- Photoresist have various hazards associated with its chemistries. It is and irritant and combustible substance.

- **HMDS**
  - P20 Liquid HMDS

**Mechanical Dangers:**
- When using the automatic features of this tools there are three sources of possible dangers for fingers.
  - When the lid is closing
  - When the dispensing arm is moving,
  - When the chuck is moving/spinning while the cover is still open.
- When the tool is under operations and exiting operation it is important that the user is aware of the placement of their hands, and tools.
- if the natural movement of the machine is obstructed in anyways by tools or other things the machine will go into failure mode or it could have a mechanical malfunction. This mean that all areas where the cover comes down should not be obstructed by substrates, tools, bottles and pens.
- Load and unload manually

**Electrical Dangers:**
- This tool is shielded to meet specification for usage yet if improperly used it can lead to electrical malfunction.

**User Responsibility:**
- all users are responsible to leave the tool under a standby condition.
- all users are responsible to work in a clean environment.
- all user are responsible to leave the tool clean.
- CNF is not held responsible for anything that is left behind in the tool.

- Since there is only a limited number of storage slots in the machine recipes are to be created and kept by the user.
- Always keep all vacuum seal clean or the tool could break your substrate. This could also result in the the damage of the Gyrset.

## Materials:

- 100 mm wafer chuck
- SU-8, KMPR, Cyclotene, AP 3000
- Microposit Edge Bead Remover EBR-10-A
- P20
- SU-8 2000 Thinner

## Tool Operation:
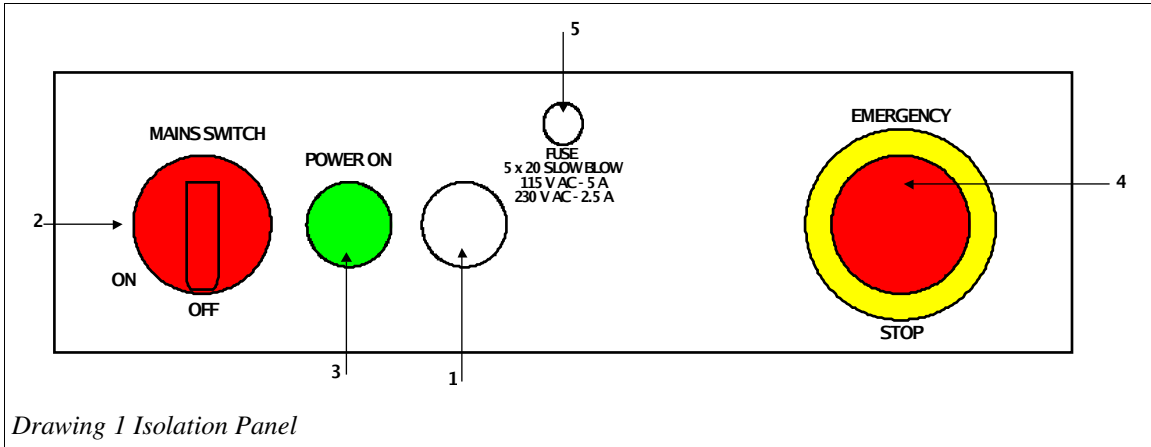


*Drawing 1 Isolation Panel*

1. Main Switch Light
2. Main Switch
3. Machine Power On Switch
4. Emergency Stop Button
5. Machine Fuse

Drawing 1 shows the Isolation Panel, this where the tool is turn on and off. This is also where the location of the emergency mushroom bottom is located. The machine will display a green light when ever it is ready. if the RC-8 appears to be off check the main switch and make sure is on the on position, secondly make sure the emergency bottom is pulled out. And finally press the power on bottom to turn on the machine.

Drawing 2 show how the CT62 RC Spin Coater Control Panel looks like. This is where the user will spend most of the time. Here you will be able to observe the speed, acceleration, program, step, process and failure modes of the tool. As your can notice the numerical pad there are number from 0 to 9 in addition to a delete button and an insert button. Some of the digits have a primary and a secondary label right under the number.

**Recipe Programming:**
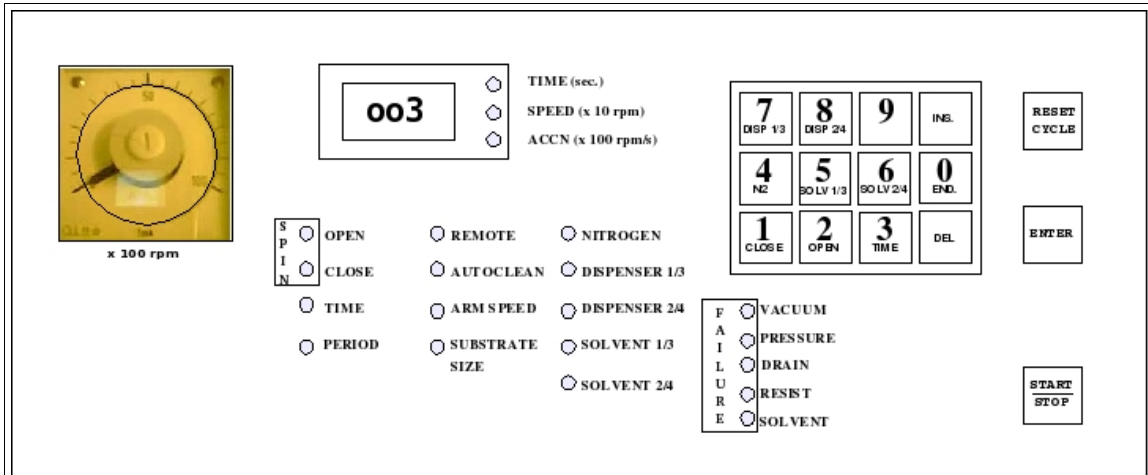


*Drawing 2 Spin Coater Control Panel*

Programming:

The program structure is very simplistic. In order to run the tool the user has to select a function and then enter the appropriate value for the function type. In the keypad from drawing 2 is can be observed that in some of the number there is one or two secondary function. The number themselves are use to enter the value.

Keyboard:

| #/Function | Description |
|---|---|
| **<1/CLOSE>** | Spinning with Gyrset Cover Close (Centrifugation) |
| **<2/OPEN>** | Spinning with Gyrset Cover Open (Drying) |
| **<2/TIME>** | Time (Delay Prior to Jumping to Next Function) |
| **<4/N2>** | Nitrogen Blow-off (Substrate Cleaning) |
| **<5/SOLV1/3>** | Solvent1 Dispense (Machine Cleaning) |
|  | Solvent3 Dispense is activated by pressing this key twice |
| **<6/SOLV2/4>** | Solvent2 Dispense (Gyrset Cleaning) |

|               | Solvent4 Dispense is activate by pressing this key twice |
|---------------|----------------------------------------------------------|
| **<7/DISP1/3>** | Dispense1 and Dispense3 (Not available) |
| **<8/DISP2/4>** | Dispense2 and Dispense4 (Not available) |
| **<0/END>** | End (End of Cycle) |
| **<INS.>** | Insert (Insert Function) |
| **<DEL>** | Delete (Reset Parameter or Delete Function) |
| **<RESET/CYCLE>** | Reset Cycle (Clear the entire function list of an existing cycle) |
| **<ENTER>** | Enter (key to validate the entered data) |
| **<START/STOP>** | Start/Stop (Cycle Execution Control) |

There are various service cycles available for programing.

Cycle '**0**' (From Machine Documentation)
- Single-step cycle allowing fast programming of servicing applications

Cycle '**1**'
- Is also a single-step cycle limited to one-step spin with cover close .
- Functions implemented in this cycle are Speed, Acceleration and Time
- 

Cycle '**2-8**'
- Are customizable cycles
- up to 30 steps are available for programming
- Functions available in this cycles include Open and Close bowl spin, Time, N2, and Solvent functions.

Note:
This tool will not have the capability of automatic resist dispense hence becoming a hand dispense unit. As a result DISP 1, DISP 2, DISP 3 AND DISP4 are not available. Backside cleaning (solvent 4) for the systems is also not available.

Solvent functions

| Solvent # | 1 | 2 | 3 | 4 | 5 |
|-----------|---|---|---|---|---|
| Function | Bowl Cleaning | Edge Bead Remover | Cotton Candy Remover | **Not Available** | Dispenser Nozzle Rinse |

Cycle Programming:

Example: Cycle # 2

oo?    Standby mode for the last cycle used in the tool

oo2    Press 2 fallowed by enter

       This selects Cycle 2 and leaves the machine in standby mode

       Pressing enter again allouds for cycle 2's edit

       Pressing delete after this deletes any previous step that was setup in the tools from

000    the previous usage. You need to do this until a prompt of capital 000 is displayed.

001    now by pressing 1 the function selected is close bowl spin. Validate the value by

300    pressing enter. The machine the prompts for a spin speed. After entering and

010    validating the value the tool will prompt for an acceleration. After entering and

000    validating the value machine will go to the end of the cycle. Since spinning

003    does not include a time the function of time has to be selected and validate along

015    with its appropriate value. Now the simple open close bowl recipe under cycle 2 is

000    complete. The tool will return to the end of cycle. By validating the end of cycle

oo2    the tool goes back to standby mode. At this point the recipe/cycle 2 is ready for

       usage. After placing the substrate in the chuck and hand dispensing the resist. The

       user will only have to press Start/Stop to run the recipe and wait till it finishes.

Cycle #2 Summary

For instance, the simple spin cycle '2' with the cover closed at 3000 rotations per minute, with an acceleration of 1000 rotations per minute per second for a duration of 15 seconds, is displayed as follows:

| | | |
|---|---|---|
| oo1 | Standby mode, cycle '2' | |
| 001 | Function '1' - spin cover closed | Green lamp CLOSE blinks |
| 300 | Spin Speed '300' - 3000 rpm | Green lamp CLOSE lights ON. Yellow lamp SPEED blinks |
| 010 | Acceleration '010' - 1000 rpm/sec. | Green lamp CLOSE lights ON. Yellow lamp ACCELERATION blinks |
| 003 | Function '3' - Time | Green lamp TIME blinks |
| 015 | Time '015' - 15 seconds | Green lamp TIME lights ON. Yellow lamp TIME blinks |
| 000 | End of cycle | |
| oo2 | Standby mode, cycle '2' | |