HPS SVT Maintenance Manual
v1.0

Authors:
Per Hansson, John Jaros, Takashi Maruyama, Omar Moreno,
Tim Nelson, Marco Oriunno, Sho Uemura[1]

June 10, 2015

[1]contact person for this document

Between run periods, both the SVT chiller (big Julabo chiller, HFE-7000 fluid) and the FEB chiller (small Anova chiller, distilled water) are kept running.

The silicon needs to be kept cool to prevent reverse annealing, so an SVT chiller outage of more than a couple of days is cause for concern. The FEB chiller is not so important (only needs to be running during DAQ tests).

The SVT chiller needs to be topped off with additional fluid every 3 weeks. When the chiller level (check the screen, visible on cctv7) reaches level 2 (see figure 2.1), follow the procedure in section 2.1.8.

Between run periods, the normal setpoint for the SVT chiller is 17 C. This keeps the SVT above dew point, so it is not necessary to maintain vacuum/dry gas on the SVT. The SLAC group may want the SVT cold for a week or two so the hybrids can be powered; the SVT needs to be under vacuum to prevent condensation. Follow the procedure in section 2.1.7 to change the setpoint.

0.1   Contact List

Contact Sho Uemura (646-833-8746, `meeg@slac.stanford.edu`, `uemura@jlab.org`). If not reachable, contact Pelle Hansson (650-391-6233, `phansson@slac.stanford.edu`, `phansson@jlab.org`).

System	Experts
General expert	Tim Nelson
SVT DAQ	Pelle Hansson
SVT EPICS controls	Pelle Hansson, Wesley Moore
MPOD power supply	Sho Uemura
PLC interlocks	Brian Eng
Cooling	Sho Uemura

Chapter 1

Controls and monitoring

1.1   SVT Cooling

All the GUIs shown below are accessed through the **Devices** menu in **hps_epics**.

Figure 1.1: SVT PLC GUI, accessed through the **Devices** menu in **hps_epics**.

Also, there is a webcam (cctv7) pointed at the SVT chiller screen. The webcam can be set to e-mail a snapshot every 24 hours.

Any major (red) ALH alarm under the "SVT/COOLING" group will send an e-mail alert.
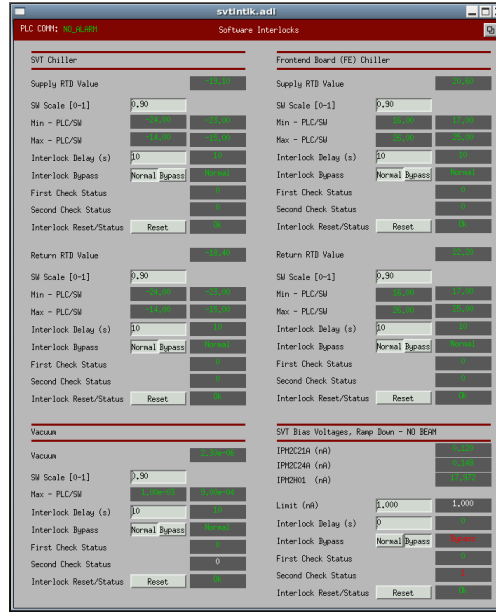
Figure 1.2: SVT software interlocks GUI, accessed through the **Devices** menu in **hps_epics**.
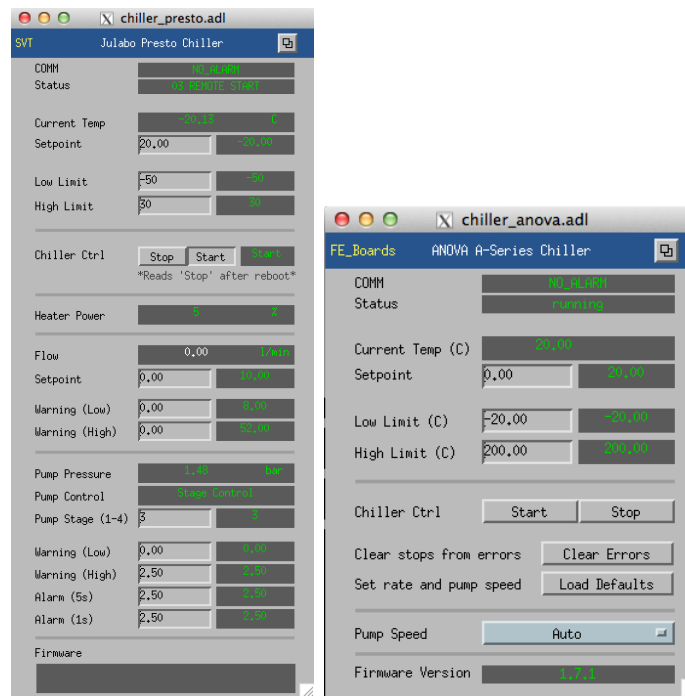

Figure 1.3: SVT (left) and FEB (right) chiller GUIs, accessed through the **Devices** menu in **hps_epics**.

Parameter	SVT warm	SVT cold
SVT chiller setpoint (C)	17	-20
SVT RTD alarms (C)	15/16/18/19	-22/-21/-17/-16
SVT RTD PLC limits (C)	bypassed	-24/-14
FEB chiller setpoint (C)	20	20

Table 1.1: SVT cooling settings.

Chapter 2

Procedures

2.1 Cooling and Interlocks

2.1.1 Start FEB chiller

1. Disable the PLC interlock for FEB flow (PLC GUI, upper right).

2. Verify that the chiller temperature setpoint is 20 C. If not, call the SVT expert.

3. Check the RTD temperature limits. The low limits should be set at 16 C and the high limits at 26 C.

4. Verify that all PLC alarms that affect the FEB chiller loop (supply RTD, return RTD, and vacuum) are in "0" state.

5. Verify that the FEB valve is open.

6. Start the chiller.

7. Wait for the flow switch value to change, then enable the FEB flow interlock. If the flow switch does not trigger, call the SVT expert.

8. At this point, the FEBs can be powered.

9. The **current temperature** shown in the FEB chiller GUI should converge to the setpoint in a few minutes.

10. When the temperature has reached the setpoint, lower the high limits in the interlock to their final values.

2.1.2 Start SVT chiller

1. Change the chiller temperature setpoint to 17 C. (This assumes the SVT cooling loop is at room temperature to start. If it is cold, start cold.)

2. Disable the PLC interlocks for SVT flow, supply RTD, and return RTD (left side of PLC GUI). Disable the software interlocks for supply RTD and return RTD (left side of software interlock GUI). Verify all PLC alarms and software interlocks are in "Ok" or "0" state, and the SVT valve is open (PLC GUI).

3. Start the chiller.

4. Wait for the flow switch value to change, then enable the SVT flow interlock.

5. Wait for the chiller temperature to stabilize at the setpoint. Some oscillation is normal in the short term, and the chiller may trip off (most likely if the chiller has been off for a while). If this happens, power cycle the chiller (power switch to the left of the touch screen, or "AC Power Enable" on the PLC GUI), and start over from the beginning of the procedure.

6. Follow the procedure in section 2.1.7 to change the temperature to its desired value.

2.1.3 Stop FEB chiller

1. Verify that hybrid bias, FEB power, and flange board power are off.

2. Press the **Stop** button in the FEB chiller GUI. The interlocks will close the FEB valve and trip the MPOD.

2.1.4 Stop SVT chiller

1. Verify that hybrid bias, FEB power, and flange board power are off.

2. Press the **Stop** button in the SVT chiller GUI. The interlocks will close the SVT valve and trip the MPOD.

2.1.5 Draining SVT chiller (experts only)

1. Disable the PLC interlocks for SVT chiller flow, supply RTD, and return RTD (left side of PLC GUI).

2. Put the chiller in manual mode using the touchscreen.

3. Follow the instructions in the chiller manual to drain the chiller. Use the big plastic jug and the two short pieces of rubber tube.

4. When you disconnect a fitting in the chiller loop, drain both connections into a beaker.

5. Purge both connections using the nitrogen line (use a Swagelok-to-VCR adapter with a used gasket), with the reservoir drain valve (the ball valve with a plastic handle) open. Be sure to cap the connection not being purged using a VCR cap and a used gasket.

2.1.6 Filling SVT chiller from empty (experts only)

1. Disable the PLC interlocks for SVT chiller flow, supply RTD, and return RTD (left side of PLC GUI).

2. Follow the instructions in the chiller manual to fill the chiller. Use the metal funnel.

3. If the final level of the chiller is below 1/4, add a full jug of HFE 7000.

2.1.7 Changing SVT chiller temperature

1. Disable the PLC and software interlocks for SVT chiller supply RTD and return RTD (these are left disabled between run periods).

2. Change the setpoint on the SVT chiller GUI in steps of no more than 10 degrees C. After each step, wait 20 minutes for temperatures to equalize in the system (chiller temperature and RTDs should stabilize in about 10 minutes). Check cooling lines for frost or melting ice.

3. When at final temperature, set the alarm and interlock setpoints for the SVT chiller supply RTD and return RTD. Re-enable interlocks if they were bypassed.

2.1.8 Adding fluid to SVT chiller

The HFE-7000 fluid for the SVT cooling loop evaporates steadily and must be replenished approximately once every 3 weeks. The fluid is supplied in 10-pound jugs. It is nontoxic and evaporates rapidly, so don't worry about small spills. The chiller should be refilled when it reaches level 2 (slightly below 1/4); one jug will take it to level 7 (slightly above 3/4). Refilling before the level drops to level 2 will cause a high level warning; waiting until the level drops to level 1 will cause a low level warning.

It is safe to add fluid while the chiller is running. This may cause a temperature spike, so RTD interlocks must be disabled.

1. Disable the PLC and software interlocks for SVT chiller supply RTD and return RTD (these are left disabled between run periods).

2. Using a funnel, pour a jug of HFE-7000 into the fill port at the top of the chiller (open the metal cover and pull out the white plastic plug). If this causes a high level warning, acknowledge it.

3. Wait 5 minutes or until temperatures have stabilized (can use the stripchart on the chiller's touchscreen).

4. Check the water level in the FEB chiller (minimum: the cooling coil should be covered, maximum: 1.5 inches below the rim).

5. Check that none of the temperatures are alarming (RTD values in the interlock GUIs should be green). Enable all interlocks that were bypassed.

6. Make a logbook entry noting the chiller level before and after the fill, and the number of full HFE jugs remaining.

2.1.9   Response to unexpected chiller trip

1. Look at the EPICS screens for the PLC. Check the alarm status fields for any PLC alarms. Also look at the software interlock screen and check the interlock status fields for any interlock faults. Call the SVT expert with the list of alarms.

2. If the expert tells you to restart the chiller: Disable all PLC alarms that have tripped. Bypass and reset all software interlocks that have tripped. Start the chiller from its EPICS screen. As alarms clear, re-enable all alarms and interlocks that you disabled. If any alarm does not clear, call the SVT expert.
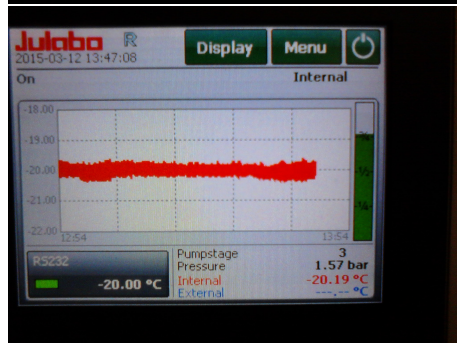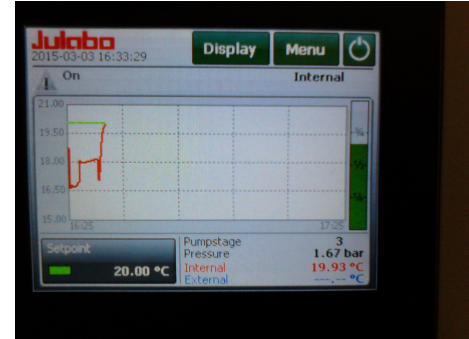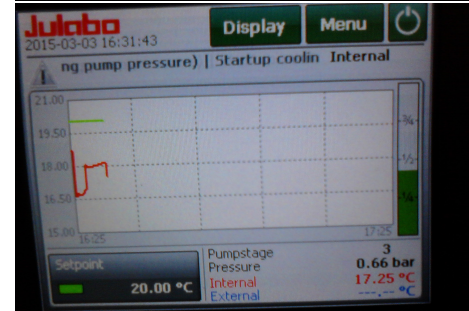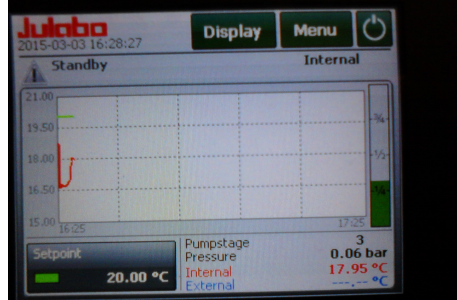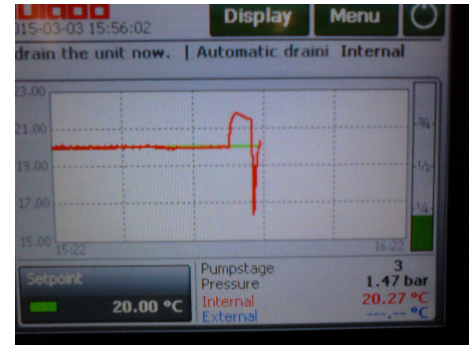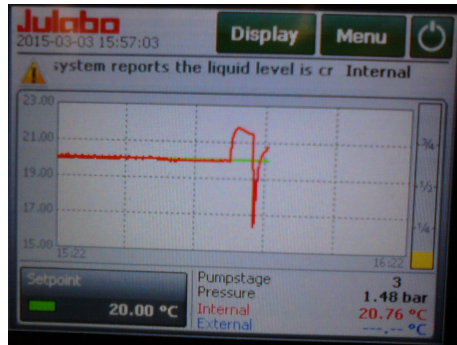
Figure 2.1: Steps of the SVT chiller level indicator (green/yellow bar on right - it may be necessary to push the green "Display" button at the top to get to this view). Level 1 (first image) is the lowest level at which the chiller will continue to run, with a low level warning alarm. Levels 2–7 are levels for normal operation. Level 8 (not shown) will cause a high level warning alarm, but the chiller will continue to run.