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Science and Technology in Italy  
For the upgraded ALMA Observatory  
- TECHNOLOGY DEVELOPMENT -

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# ALMA B23 CRYO CHAIN CONTROL PROCEDURE

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## 1 Change Record

Version	Date	Affected sections	Reason
0	10/01/2016	All	Draft version
1	28/03/2017	All	Final Revision

## 2 Applicable and reference Documents

### 2.1 Applicable documents

AD-1.			
AD-2.			
AD-3.			
AD-4.			
AD-5.			

### 2.2 Reference documents

REF1.	ALMA Band 2(+3) Cryogenic Design Report	Report	2013
REF2.			
REF3.			
REF4.			



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### 4 Aim

In this document, we describe the procedures to correctly operate the NAOJ Cryofacility Equipment once the cryostat is closed and sealed. The Cryostat is currently installed at the Cryowaves lab at the premises of INAF -IASFBo.



## 5 PUMP VACUUM & COOLER SWITCH ON

- 1- Close the **butterfly** venting valve below the cryostat.
- 2- Close the **black** venting valve below the TURBO pump (rotate CLOCK WISE)



### 3- Switch ON the SCROLL PUMP

- a. Push the switch button



- 4- gently open the black valve below the TURBO pump (rotate COUNTER CLOCK WISE)



- a. Let the SCROLL pumping for at least 2 hours
- b. Check that vacuum went down below  $5 \times 10^{-2}$ , otherwise wait.

5- Switch ON TURBO PUMP from Edwards Panel

- a. Push "o()o" command



- b. Move to "turbo" using arrows

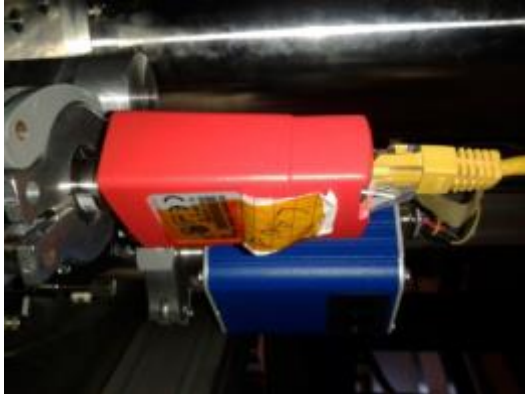


- c.
- d. Push again "o()o" command to switch ON



**6- Wait until vacuum is below  $10^{-4}$  (from Edwards Panel)**

(identify the APGX port connected to the Edwards: if the yellow cable below is connected to the 3<sup>rd</sup> port (GAUGE 3), it is the 3<sup>rd</sup> row in the Edward (move along 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> row using arrows)



**7- SETTING THE TEMPERATURE SENSORS:**

**SETUP:** All 4 sensors (cryo chamber-cryostat) are connected to the flat wire entering lakeshore 3468 input C.



SENSORS can be alternatively set by LV VI or by Lakeshore panel. The procedure from Panel is preferred.

a. PANEL PROCEDURE:

i. Input setup



ii. Use arrows and select C (10 channels available: A, B, C1:4 , D1:4) since the FLAT cable is connected to input C.



iii. Press **enter**



- iv. Use arrows to **select C1**
- v. Press **enter**
- vi. Cursor moves to **Enable:** select **ON**
- vii. Press **enter**
- viii. Cursor moves to **curve**
- ix. Select **DIODE 670 (standard curve)**
- x. Press **enter**
- xi. Press save screen

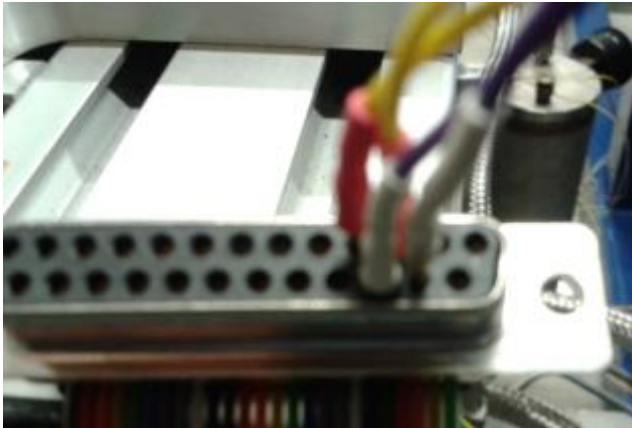


- xii. Repeat operations for sensors from C2 to C4
- xiii. Press cancel screen to read the display (temperatures)



**NOTE: if the lakeshore 1 does not switch on check the fuse (1A; on 09/01/2017 substituted the white fuse. Yellow box with spare fuses on the soldering table, 4<sup>th</sup> box))**

**In the case that INAF NI bias supply is used**, the sensor placed on the cold LNA is acquired in **D1** and must be set using the same procedure as above. The connector is wired as in the picture below.



## **8- START DATA ACQUISITION**

From computer:

- a. Open the vi. and run it (by pressing the Arrow on top left)
- b. Select the sample rate of acquisition (25 s, suggested) and click apply
- c. Go on the top bar and follow the File menu >> data logging >> lakeshore 340 C
- d. Type the desired filename to record data
- e. Push the red button (RUN): the lakeshore controller switch to "remote" condition.

## **9- COOLER OPERATION**

From the BOX outside the Lab building:

- a. Verify that the general ON/OFF switch (figure here below) is ON



- b. Identify The compressor powering ALMA cryostat: is the water compressor on the CENTER (SUMITOMO Model F-50).



- c. Verify that all the water circuit valves (connected to relevant black tubes) are open. Usually they are kept open.



- d. Verify that CHILLER is working (outside the BOX, extract the control panel and press an arrow to light the display). Normally the chiller is always ON.



- e. Get back to the cooler compressor inside the compressor local and rotate MAIN switch to 1 (black switch).



- f. Switch ON the "DRIVE" switch (right button, see left figure below) [Do not handle the other switches whose settings are: COLD HARD DRIVE >> OFF; REMOTE DRIVE >> LOCAL]

- g. Read the supply pressure right figure below: it should be > 2



- 11- WHEN CRYO Temperature is reached, go on the lab PC and in the .vi panel:
- Press stop [Stop] control
  - Press [Exit] control
  - Start again .vi and follow instructions of point 8. to start a new acquisition file.

## 6 WARM UP

### 6.1 HEATERS SETUP:

3 heaters connected to 6 wires (black connector below cooler)



- The shorter (black and red bananas to be connected to power supply: NOT USED AS BASELINE-110K stage)
- 150 ohm to ANALOG OUT (LOOP 2) @ RT (190 @ cryo) - stage 4K
- 102 Ohm to HIGH-LOW Output (LOOP 1) @ RT (133 @ cryo) - stage 15K

### 6.2 SENSORS SETUP:

- C1 = 110K
- C2 = 20K
- C3, C4 4K (C4 on the cold finger)

- On the Temperature Controller front panel press LOCAL (if the acquisition .vi LV program is set to 25 sec sampling it is easy to switch from Remote to LOCAL; instead, in the case that sampling is set to 1 sec, it is better to stop the LV acquisition to avoid that Remote condition is automatically activated by the .vi)

2- Read Resistances by a MULTIMETER and compare to the above values  
(at cryo)

3- Set the heaters by LAKESHORE PANEL:

a. Control setup (left panel)



b. Press ENTER to navigate

c. **LOOP 1:**

i. Set the Values as reported in the HEATERS SETUP condition (above) and in the pictures



ii. Set Ctrl Mode to AUTO PID



- iii. Press MORE to set the set point temperature (TEMP) and the Heater range



- iv. Save screen

**d. LOOP 2:**

- i. Set The Values as reported in the HEATERS SETUP condition (above) and in the pictures (Ctrl mode > manual PID; Enable > ON)



- ii. Press MORE to set the Set point temperature (TEMP)



iii. Save screen

e. **Match LOOP 1 with the corresponding sensors** (following the pairing scheme reported in HEATERS SETUP and SENSORS SETUP above)

i. Press: LOOP 1



ii. Set control channel



- iii. Use arrows and enter to navigate and match the proper sensor
- iv. Save screen

**f. REPEAT for LOOP 2**

**g. Verify that LOOP 1 heater program is active and not off**

- i. Press: LOOP 1



- ii. Press heater range



- iii. Select the max heater range using the Up and Down arrows



iv. Press save screen

4- Check that acquisition is running, otherwise run LV

5- On the cooler compressor in the box outside:

- a. Switch OFF drive
- b. Switch OFF MAIN

**WAIT 30'**

### 6.3 TURBO PUMP SWITCH OFF

- 1- **Close** the black valve below the TURBO pump (rotate clock WISE)



- 2- **Switch OFF** TURBO from Edwards Panel

- a. Push "o()o" command



- b. Move to "turbo" using arrows



c. Push again "o()o" command to switch OFF



**Switch OFF the SCROLL**



3- after about 36 hours, when all 4 sensors are  $> 280$  K, the venting valve below the cryostat can be opened.

## 7 TURBO PUMP SWITCH OFF (@ RT)

In the case that the cryostat is left warming up overnight, and sensors are all above 280K with the TURBO still ON:

- 1- **Close** the black valve below the TURBO pump (rotate clock WISE)



- 2- **Switch OFF** TURBO from Edwards Panel

- a. Push "o()o" command



- b. Move to "turbo" using arrows



c. Push again "o()o" command to switch OFF



**3- Wait until the TURBO is about still before opening the vacuum valve**

a. From Menu



- i. Go to "PUMP STATUS" using "enter"



- ii. Read the turbo speed: vacuum cannot be broken if speed is not below 50% (It is suggested to wait when it is about 0%)

- 4- Switch OFF the SCROLL



- 5- Open the venting butterfly valve