

# Oxford Instruments Cryomagnet Operation

The Oxford Instruments Cryomagnet is cooled by continuously pumping the heat exchanger via the Helium pumping valve over the entire temperature range (2-300k).

**To cool the magnet, follow the steps below:**

Connect the SE XDS 35 Support Pump (Fig 1b) via KF25 flexible to the cryomagnets KF25 He pumping valve (Fig 2).

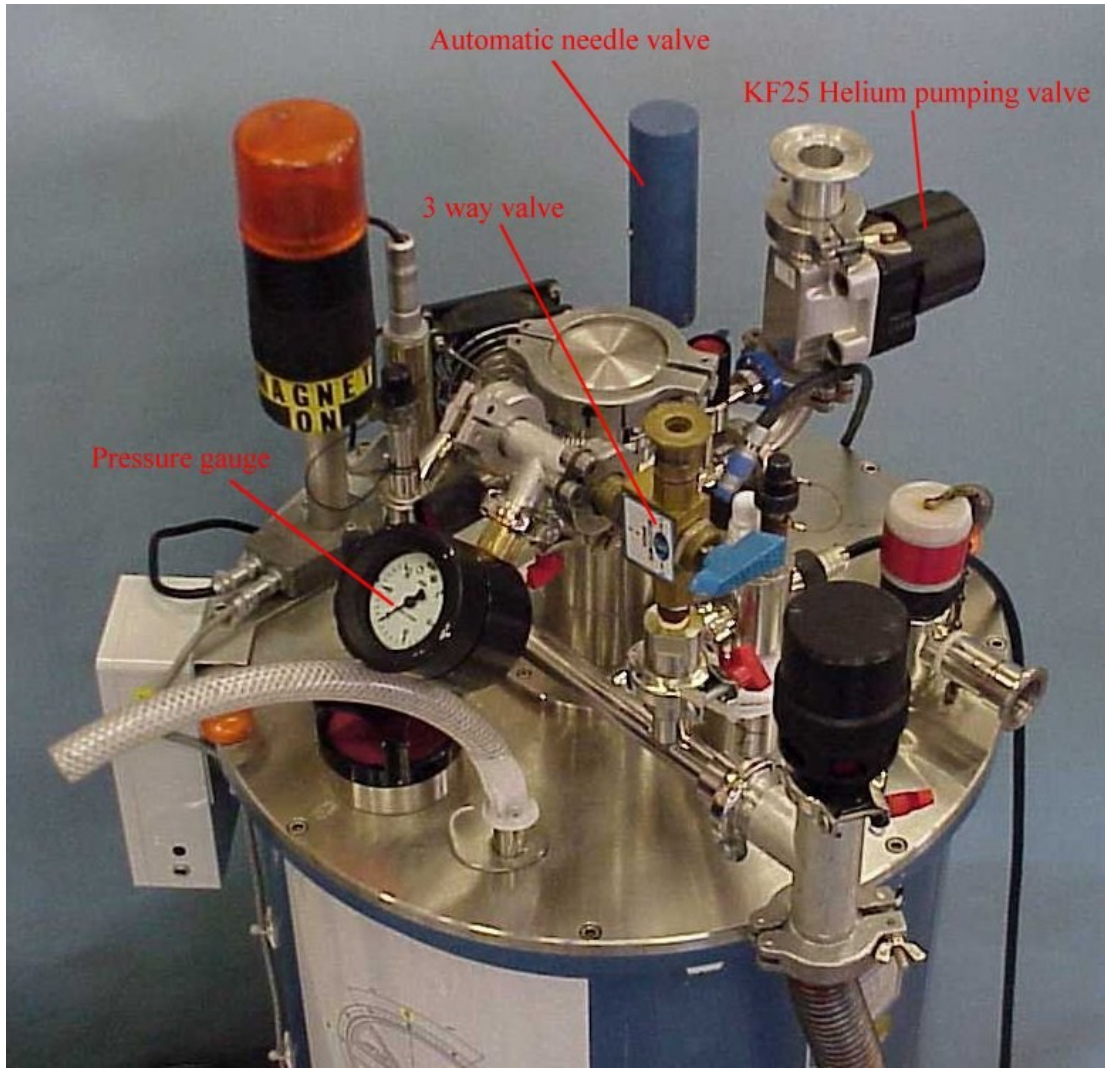


Fig 1a



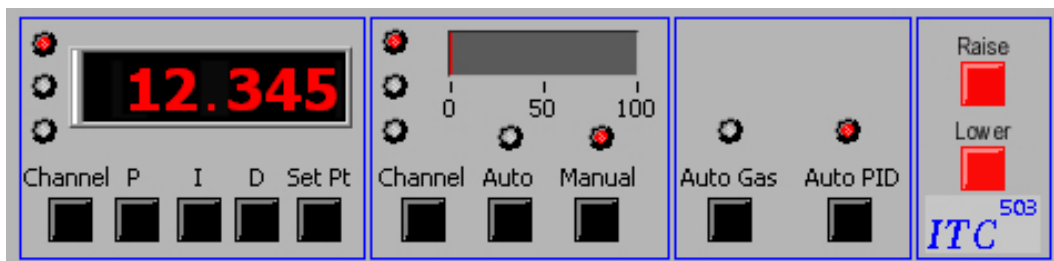
Fig 1b

Turn on the pump open the KF25 pumping valve and evacuate the line, **then** open the cryomagnet KF25 He pumping valve.



(Fig 2) Cryomagnet top flange

Set the required temperature set point and its corresponding P.I.D values on the ITC503 temperature controller (Fig 3). P.I.D values are featured on the following page and can also be selected automatically (see automatic temperature control section).



(Fig 3) ITC503 temperature controller front panel

To set the required temperature hold down the 'Set Point' button and toggle the 'Raise' and 'Lower' buttons until the required set point is obtained, a table of typical values is given below:

ITC5 Temperature Controller Settings										
Temp (k)	3.0	4.2	6.0	10	20	50	77	100	200	300
Flow (l/m)	5	4	4	3	3	2	2	2	1	1
P	30	25	25	25	16	13	12	12	12	6
I	0.1	0.2	0.2	0.2	0.3	0.3	0.5	0.7	1.1	1.5
D	0	0	0	0	0	0	0	0	0	0

The magnet can be cooled either manually or automatically.

### Manual temperature control

Set the cryomagnet ITC503 temperature controller (Fig 3) gas flow to approximately 25%, this can be done by pressing and holding down the gas flow button (the display will change from temperature to percentage) and then simultaneously pressing the raise button. The flow gauge on the pump exhaust should increase and reach a value of 10 l/min; if the flow doesn't reach this, then adjust the gas flow until it does.

When the cryomagnet reaches the set point, reduce the flow by adjusting the gas flow on the cryomagnet ITC503 to a value that sustains the set point temperature.

### Automatic temperature control

**Note: Do not specify a set point below 5K, as this temperature is unachievable with this cryomagnet in auto control mode.**

Assuming that the set point has been set to a value greater than 5K. Toggle the following switches to auto; Heater, Gas, P.I.D. Confirmation that auto has been selected is by the illumination of each panels LED light.

To use the ITC503 with manual P.I.D first set the P.I.D values and then toggle the following switches to auto: Heater, Gas.

The automatic needle valve will open fully and the Cryomagnet will start cooling, when the set point is reached and passed the heater will come on. The automatic needle valve will maintain a flow of Helium through the heat exchanger while the heater attempts to control the Cryomagnet at the set point.

## Changing a sample in the cryomagnet

### Inserting the Sample stick

Before commencing this procedure ensure the following:

- a.) The cryomagnet is at 80K or above.
  - b.) The cryomagnet is connected to the Helium recovery panel or has a non-return valve connected to the Helium exhaust.
  - c.) The Sample stick and sample are fully prepared and ready to be inserted.
1. Connect the KF10 flexible from the SE XDS 10 Support Pump (Fig 1a) to the blue 3 way valve on the cryomagnet top flange (Fig 2); ensure that a helium gas supply is connected to the pumps gas valve.
  2. Evacuate the line.
  3. Turn the 3 way valve vertically UP to open the sample volume to the pump, close the vacuum valve and open the gas valve to fill the sample volume with Helium exchange gas.
  4. Remove the KF50 blank and carefully insert the centre stick and tighten the KF clamp.
  5. Close gas valve and open vacuum valve on pump to evacuate the sample space of Helium exchange gas.
  6. When pressure gauge on the rotary pump reaches zero, re-introduce Helium exchange gas by closing the vacuum valve and opening the gas valve.
  7. Close the gas valve and open the vacuum valve and throttle the valve until the pressure gauge on the rotary pump reads 30-40mbar.
  8. Turn the 3 way valve HORIZONTAL
  9. Connect the electrical leads to the top of the Sample stick.

## Removing the Sample stick

Before commencing this procedure ensure the following.

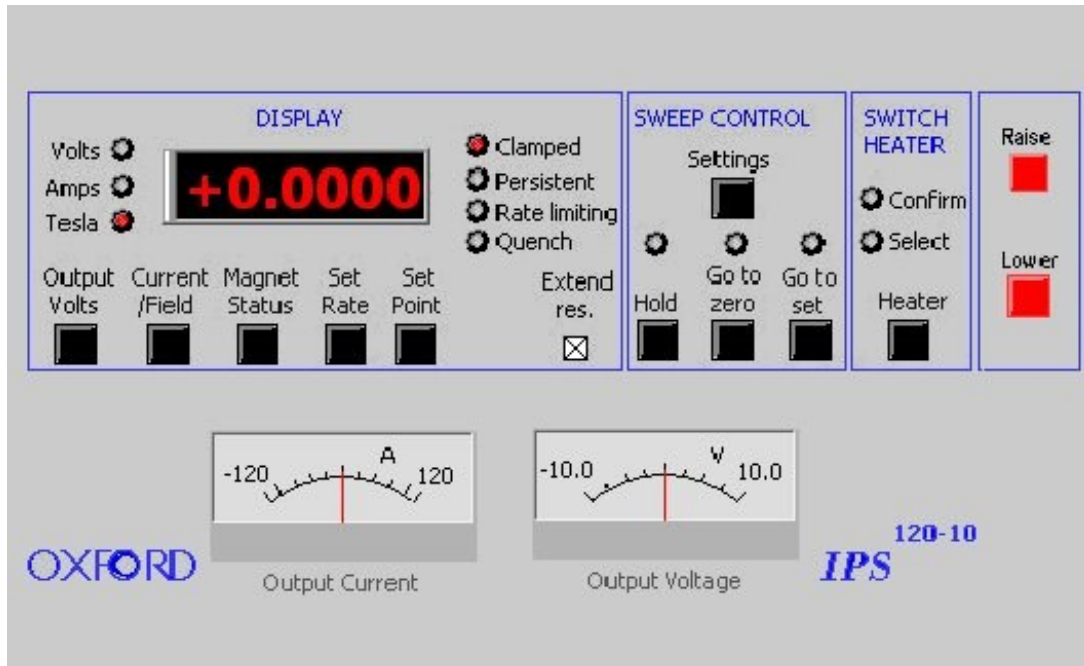
- a) The Cryomagnet and sample are at 80K or above.
  - b) The cryomagnet is connected to the Helium recovery panel or has a non-return valve connected to the Helium exhaust.
  - c) The KF blank is available.
1. Disconnect the electrical leads from the centre stick.
  2. If not already connected, connect the SE XDS 10 Support Pump (Fig 1a) to top of blue Hoke valve and start the pump to evacuate the line, ensure that a helium gas supply is connected to the pumps gas valve.
  3. Turn the 3 way valve vertically UP to open the sample volume to the pump then close the vacuum valve and open the gas valve to fill the sample volume with Helium exchange gas.
  4. When the sample volume is at atmosphere, remove the KF50 clamp and carefully withdraw the sample stick and then replace with the blanking flange and clamp.
  5. Close the gas valve and open the vacuum valve until the pressure gauge on the rotary pump reads 0mbar, turn the 3 way valve HORIZONTAL

**Note! Before reusing the Sample stick ensure that any moisture is removed by using a hot air blower and wipes.**

## 7.5t Cryomagnet manual control instructions

### Warning

**Before connecting the IPS120-10 (Fig 4) to the mains connect both ends of the magnet current leads and the persistent mode switch heater to the magnet.**



(Fig 4) IPS Front Panel

1. Press **'On/Off'**. The **'Standby'** light extinguishes. The **'Power on'** light indicates. The unit displays P52.04, then 0.000 and after a short time the **'Clamped'** light indicates.
2. Press **'Hold'** on sweep control. There is an audible clunk as the **'Hold'** light indicates.
3. If the tesla light isn't illuminated, press **'Current / Field'** to toggle the display.
4. Press **'Heater'** until the Switch heater confirm and select light stays on.
5. Hold down **'Set point'** on the display panel and press **'Raise'** on the adjust panel until the required field is shown.
6. Hold down **'Set rate'**, the display should indicate 0.400 T/min. If different press **'Raise'** or **'Lower'** until is the correct value is obtained.
7. Press **'Go to set'** on Sweep control. Both Output Current and Output Voltage meters will display forward and Charge respectively (levels above approximately 0.2 Tesla will cause the amber warning beacons on both the IPS120-10 and the cryomagnet to flash).

Once the set field has been attained the Output Voltage will fall to zero and the output will be at a value equivalent to the set field. The Hold light will be off and the rate limiting light will remain on throughout.

8. Press **'Hold'** on sweep control. The hold light illuminates.
9. Once the required field has been attained and the system is on Hold. The cryomagnet may now be put into persistent mode as follows.
10. Hold **'Heater'** until the Switch heater Select and confirm lights extinguish.
11. Wait for up to 10 minutes (during this period the switch heater will cool to Helium temperatures and become superconducting).
12. Press **'Go to zero'** on Sweep Control, immediately the display will show the field apparently falling (it is actually the power supply current falling).
13. If the display does not reach zero and rises back to its original set point repeat from step 11.

The cryomagnet is now persistent and as both meters are at zero the only visible indication that a field exists are the two flashing amber warning lights. (One on the cryomagnet and one on the control rack). The IPS120-10 is programmed with maximum energising rates for all field values.

**Note:** If the cryomagnet quenches do not switch off the magnet power supply: the controller will automatically run the power supply down to zero at a controlled rate.

**To change the field to a different value, or to zero it; the cryomagnet must be taken out of persistent mode as follows.**

1. Press **'Go to set'** on Sweep control. The current in the leads will now rise to the original set point value.
2. Hold **'Heater'** until the Switch Heater confirm and select lights remain on. This is only possible when the set point has been achieved.
3. Press **'Hold'**, the hold light illuminates.

**To change the field to a different value**

1. Adjust **'Set Point'** on the display panel to the new value.
2. Press **'Go to set'** on Sweep Control. (Follow steps 7 - 13, page 7).

## To zero the field

1. Press '**Go to zero**' on sweep control; at zero field **ensure** that the switch heater is turned off.

### WARNINGS:

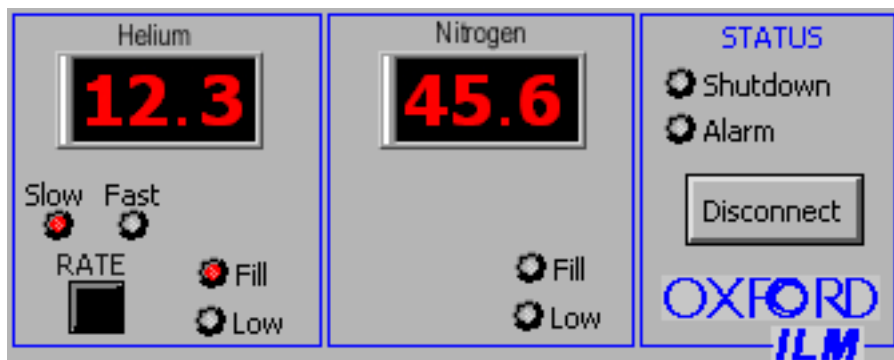


Fig 5 ILM Front Panel

- **If the helium level in the magnet reaches 10% the IPS will automatically ramp the magnet to zero field.**
- **Ensure the cryomagnet is returned to persistent mode to conserve Helium.**
- **Only move the cryomagnet when at zero field.**
- **Only reverse the cryomagnet's polarity at zero field.**