

BlueFors



CRYOGENICS

BlueFors Bottom Loading Fast Sample Exchange Mechanism

OPERATING MANUAL

2017 rev.2

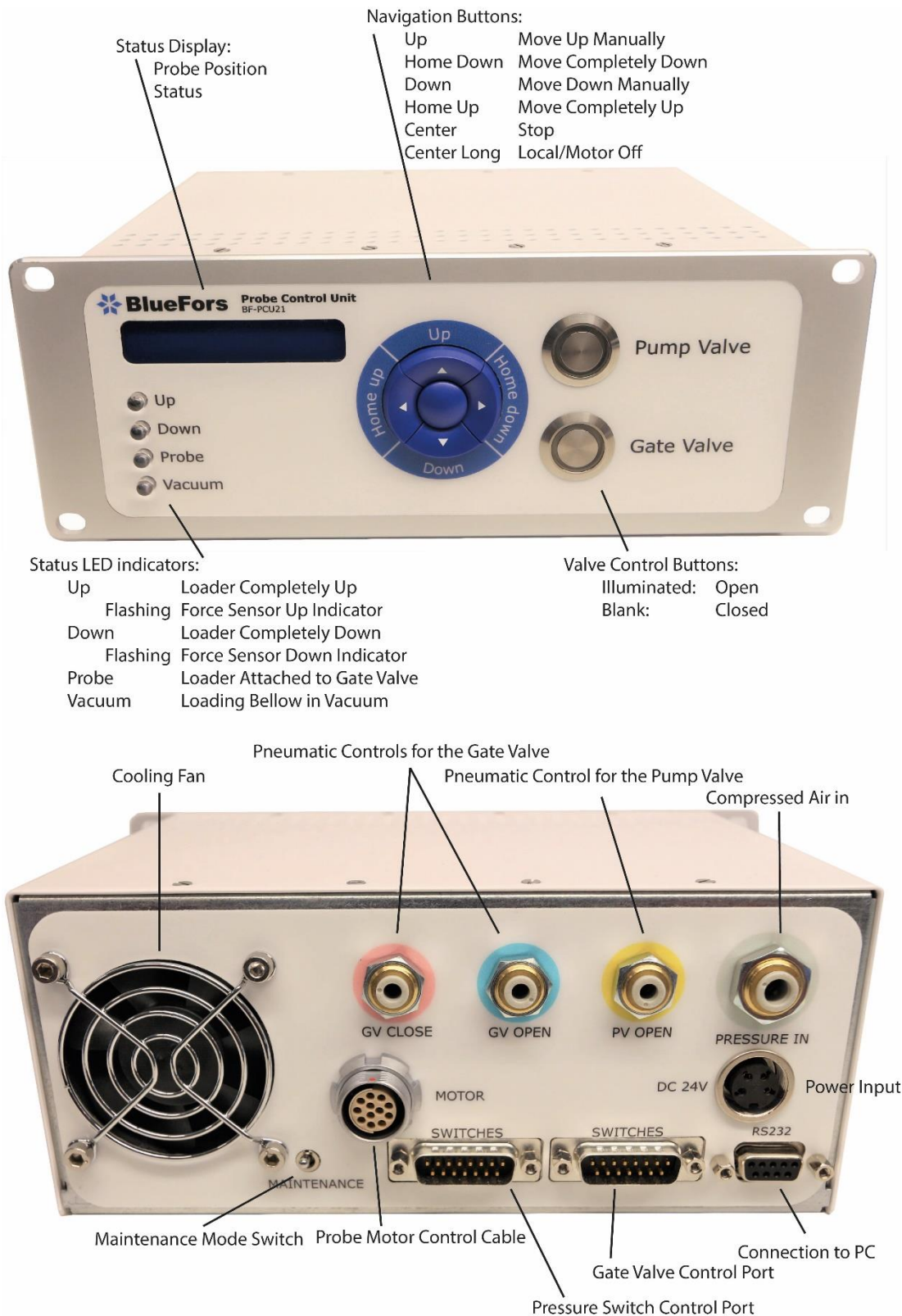
1. General Information

This document describes the cooldown and warmup procedures for the BlueFors fast sample exchange mechanism. A separate performance sheet is provided with each fast sample loading system. Please refer to the performance sheet for system layouts, pre-cooling sequence, performance and wiring for more details.

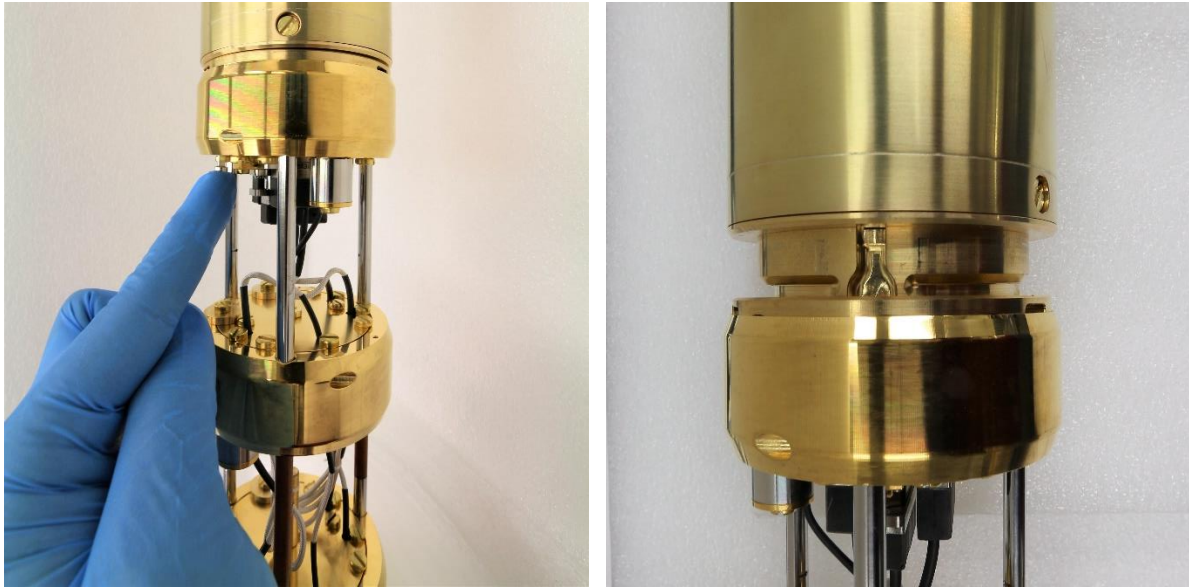


2. Operating Manual

2.1. Controller Overview



2.2. The Detach Mechanism

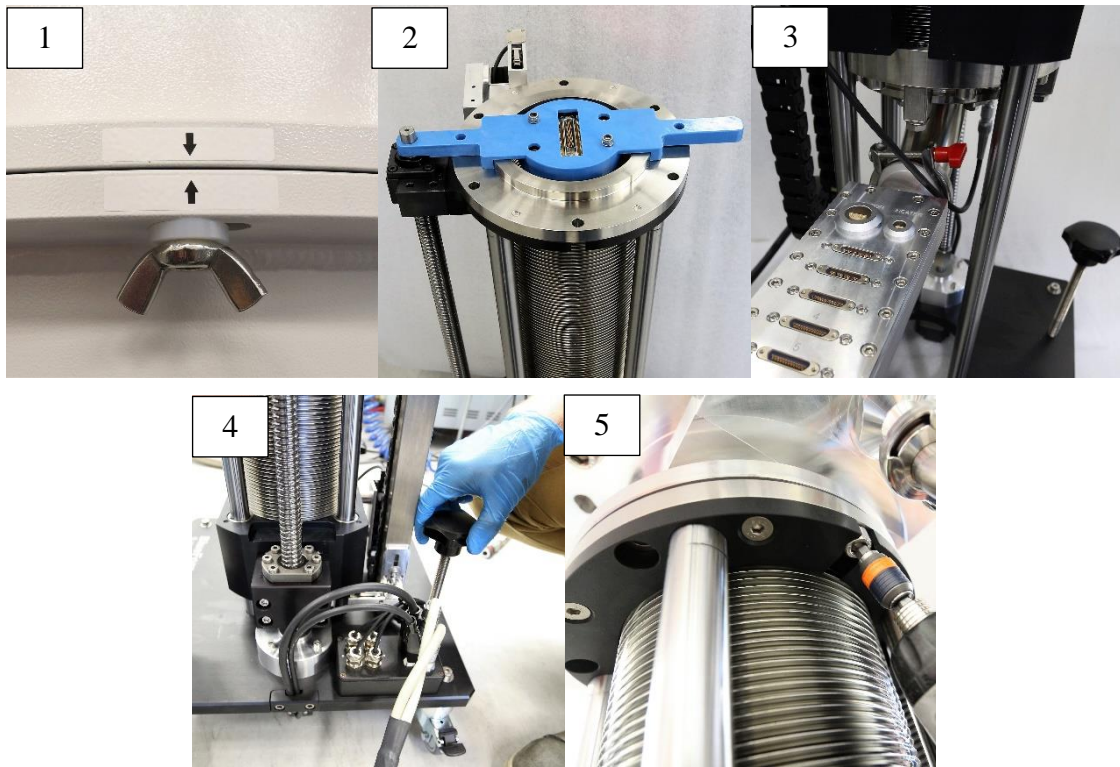


The sample space of the probe and the DC wiring is thermally isolated from the hotter stages with a detach mechanism. The detach mechanism is unlocked by pressing the key pin shown in picture above. This should always be done before inserting the probe to the cryostat.

As the probe is inserted in the cryostat, after the connectors have successfully made contact, the loader will decline to normal operating position. The RF grounding cables are detached and the MC tube will become thermally isolated from the Still flange.

When the probe is withdrawn, it should first go to *Home in* position. The MC tube is locked to the still puck, and the grounding wires connect. After this, the probe can be taken to *Home in* position.

2.3. Mounting the Probe Mechanism



- Make sure the radiation shields and vacuum cans are aligned according to the marks (Fig. 1). The markings are aligned with the still line.
- Check the orientation of the probe with a special tool (Fig. 2). Make sure the probe is properly attached to the loader. Fine tuning of the orientation can be done with the puck screws slightly loose (Fig. 7).
- The surfaces for the thermal contact should be cleaned. Add graphite to the puck surfaces regularly to avoid unnecessary friction on the probe. Clean the surfaces with ethanol/acetone before and after applying graphite.
- Make sure the detach mechanism key button has been pressed.
- The o-ring surfaces of the probe and the bellow tube and the rubber gasket should be cleaned.
- Make sure that the force sensor lead is connected to the probe (Fig. 3).
- Move the probe to *Home out* position.
- Bring the loader beneath the cryostat on the casters. Once the alignment is close, lock the casters and use the integrated feet to lift the loader against the gate valve, see Fig 4. Use cleaned O-ring.

- Fix the bellow to the gate valve with 6 bolts, see Fig. 5. First, leave an even gap (2 mm) on all sides and make sure all the bolts go on the threads nicely.
- Raise feet so that the mechanism hangs freely from the valve, and firmly tighten the bolts.
- See that the probe controller is on normal operation mode and that the gate valve is connected to the AUX port.

2.4. Cooling Down the Probe

- Start pumping vacuum to the probe bellow with Scroll2 until **p6** is 1 mbar (open: pump valve, v20, v21).
- High vacuum pumping by Turbo 2 (close v21, open: pump valve, v20, v22, v23)
- **Pump for at least 30 minutes.** Pressure on **p6** should have reached a value under $2E-3$ mbar. Stop pumping, close valves (pump valve, v20, v22, v23).
- Set dilution refrigerator to safe circulation mode: stop circulation turbo molecular pumps (turbo 1) and open valve v13. Valves v1, v10, v13, v9, v7 and v4 are open, scroll 1 is pumping.
- **The following steps can be done with the script:**
 - Open the gate valve.
 - Move the bellow to *Home out* position first.
 - Precooling in stages can also be done with a script. The probe will cool down on each stage for the optimal cooldown time (see the previous section for the sequence positions and waiting times).
 - Insert the probe gradually all the way in, movement stops on the force sensor. The connectors on the probe mate.
 - Release tension on the force restraining spring, and disengage the mechanical heat switch and grounding wiring by lowering the probe (see operating sequence for normal operation position).
 - Switch the motor off (not the whole unit!).
- If the system is at elevated temperature and the dilution refrigerator is not in normal circulation mode:



- Make sure that both **HS-ST** and **HS-MC** are switched on.
- Wait for the system to cool below 5K (still).
- Condense normally.

2.5. *Warming the Probe*

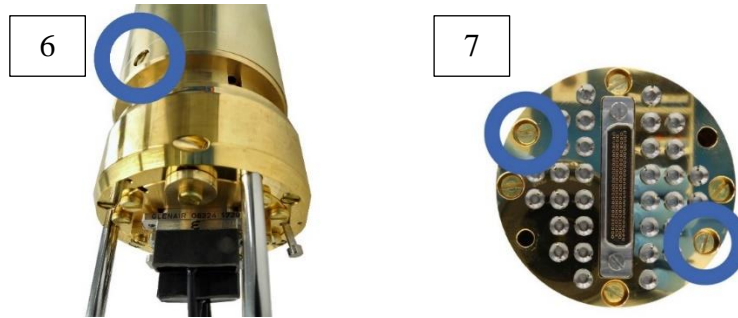
- Set dilution refrigerator to safe circulation mode: stop circulation turbo molecular pumps (turbo 1) and open valve v13. Valves v1, v10, v13, v9, v7 and v4 are open, scroll 1 is pumping.
- Switch the motor on and move probe to *Home in* position to lock the cables and the detach mechanism.
- Move the probe to *Home out*. Make sure the probe is completely down before proceeding.
- Close the gate valve.
- Soften vacuum of the probe (Open v19, close v19. Open v20 and pump valve).
- If the system is at elevated temperature and the dilution refrigerator is not in normal circulation mode:
 - Make sure that both **HS-ST** and **HS-MC** are switched on.

The next steps can be done when the probe is above 290 K:

- Vent the probe when it is above 290 K (open: v19, v20, pump valve)
- Adjust the integrated feet so that the mechanism stands on them.
- Detach the bellow from the gate valve (6 bolts).
- Lower the probe mechanism down using the integrated feet, so that it stands on the casters.
- Unlock the casters and move the whole probe mechanism to open area.
- Move the probe to *Home out* position and gently warm up the probe with a heat gun so that the probe is dry completely. Do not overheat the probe to over 50°C.



- The MC-tube can be opened carefully to reach the sample space. First, open the two screws on the MC tube and disconnect the necessary wiring. Now the tube can be detached from the MC puck to get access to the sample space.



2.6. Changing the Probe

The probe can be changed to the loader by taking the mechanism to *Home up* position, when the loader is not attached to the gate valve. The procedure is easier, if the MC tube is removed from the probe first, and the mechanism is lifted higher from the floor level with the integrated feet. The probe is removed by opening the clamps holding the ISO100 flange. Please use caution when opening the clamps to avoid any damage to the vacuum surfaces or the thermalization pucks.

2.7. Notes and warnings

- Make sure that the force restraining sensor lead is connected (Fig. 3).
- Never move the probe when there is field in the magnet.
- Precooling is necessary when inserting the probe.
- Make sure the orientation of the probe is correct (Fig. 2).
- Applying graphite to the thermalization surfaces regularly increases the lifetime of the probe/contact rings.