

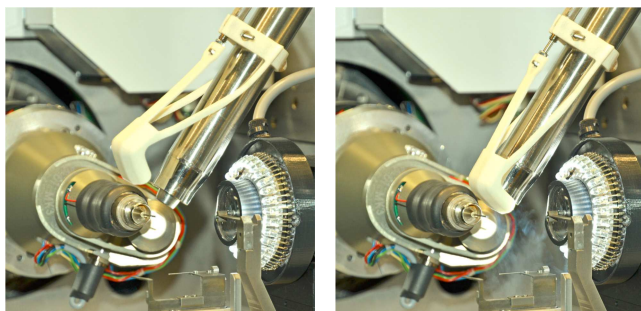
## Cryo Shutter

Cat. No.	Amount
CC-330-19	1 Assembly Kit
CC-330-19LTD	1 Assembly Kit
CC-330-22	1 Assembly Kit

### Introduction

#### Crystal Annealing

Cryogenic data collection is a tight rope walk between lowering radiation damage and increasing mosaicity due to lattice disordering produced during cooling of the crystal. Cryo-annealing can significantly reduce the mosaicity of the crystals and can also improve diffraction of flash-cooled crystals that were mistreated during transfer to and from cryogenic storage [1].



**Fig. 1:** Cryo Shutter Installed at BL14.1 (BESSY-II, HZB Berlin-Adlershof); Left: Normal position; Right: Closed Shutter

#### Types of Cryo Shutters

The Cryo Shutter was developed for Cryojet XL / Cryojet 5 systems (Oxford Instruments, 19 mm nozzle) and Cryostream 700 series (Oxford Cryosystems, 22 mm nozzle).

Various kits, differing in the shutter geometry, are available to meet the specific needs of each system:

- CC-330-19 for Cryojet systems (Oxford Instruments, 19 mm nozzle)
- CC-330-19-LTD for Cryojet systems (Oxford Instruments, 19 mm nozzle) with limited space, e.g. when using a mardtb with an optional phi swing
- CC-330-22 for Cryostream 700 systems (Oxford Cryosystems, 22 mm nozzle)

### Specifications

#### General

Operation purpose: Blocking of cryogenic nitrogen gas  
Max. operating time: 60 sec

#### Compressed Air

Operating medium: Compressed air quality to ISO 8573-1:2010  
Operating pressure: 5 - 7 bar

#### Ambient Conditions

For indoor operation only!  
Temperature range: 4 - 35°C

#### Power Supply

Operating voltage: 100 - 240 V/AC, 50/60 Hz  
Adaptor: USA/Japan, Europe (except CH and GB), Great Britain, Australia

#### Control System

Interface: USB  
Power input via USB: 120 mA  
PC operating system: Windows XP or advanced

#### Option

If compressed air is not available, the following external supply unit is adequate:

Medium: Nitrogen or similar  
Container: MAXICAN 1.2 liter  
Inflation pressure: 40 bar  
Pressure-reducing device: C260 Maxi  
Supplier: Linde AG

## Cryo Shutter

### Hardware Installation

#### Kit Components

Part No.	Amount	Description
1	1	Shutter
2	1	Round Cylinder
3	1	Solenoid Valve
4	1	Connecting Cable
5	1	Silencer
6	2	Push-in Fitting
7	1	Plastic Tubing 3 mm
8	1	Plastic Tubing 4 mm
9	1	Plastic Tubing 6 mm
10	1	Power Supply Unit
11	1	USB Switch
12	1	Hex Socket Cap Screw M2x12
13	1	Hex Nut M2
14	1	Push-in Connector QSM-4-3
15	1	Push-in Connector QSM-6-4

#### Additional Material Needed

- Cable ties to fix the pneumatic tubings
- Wrench and screwdriver

#### Shutter Installation

The shutter (part no. 1) and round cylinder (part no. 2) are screwed gently together using the hex nuts of the round cylinder. The shutter and round cylinder are then fixed at the nozzle of the cryosystem using the hex socket cap screw (part no. 12) and the hex nut (part no. 13).



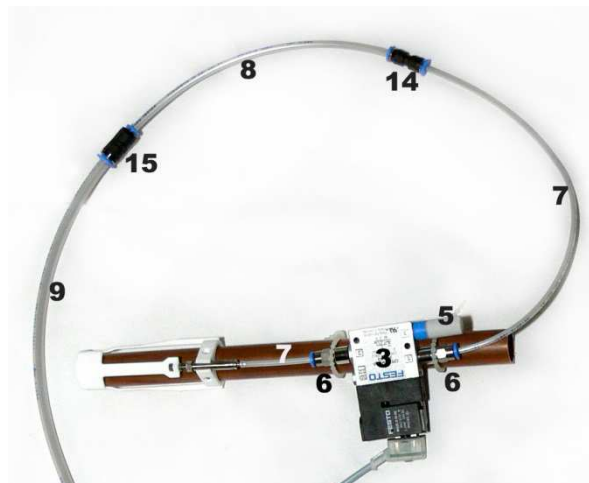
**Fig. 2:** Shutter Installation

#### Pneumatic Drive Installation

The solenoid valve (part no. 3) is complemented with both push-in fittings (part no. 6) and the silencer (part no. 5).

The solenoid valve must be fixed near the round cylinder: The length of the plastic tubing (3 mm, part no. 7) connecting the solenoid valve and the round cylinder (part no. 2) should not exceed 1m, since its lengths directly contributes to the consumption of compressed air. The 3 mm plastic tubing is cut to the desired length. One end is pushed onto the hose nipple of the round cylinder, the other end is pushed into the push-in fitting at position 2 of the solenoid valve.

The 3 mm plastic tubing is further used to connect the solenoid valve to the compressed air supply system, via position 1 of the solenoid valve. Various adapters are available to meet the user's specialized system requirements (part no. 8, 9, 14, 15).



**Fig. 3:** Pneumatic Drive Installation

## Cryo Shutter

### Electric Control Installation

The USB switch (part no. 11) is connected to the power supply unit (part no. 10). The connecting cable (part no. 4) is used to connect the solenoid valve (part no. 3) to the USB switch. The USB plug is connected to a compatible PC.



Fig. 4: Electric Control Installation

### Shutter Control Software

The shutter control software requires Windows XP or a later version. It is a single exe file copied to a PC and started directly without installation.

The USB switch may be connected to the PC while running the program or before, its successful detection is indicated in the footnote of the control software by a green status display and the note "USB switch ready".

### Operating the Cryo Shutter

The USB switch must be connected (and successfully detected) to a PC to activate the following control elements of the Shutter Control Software:

- **Anneal time** Configuration of the blocking time from 1 sec up to 60 sec

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- **Anneal Xtal** Blocking of cryogenic nitrogen gas for the set time interval; a yellow status display indicates a closed shutter

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- **Abort** Immediate opening of the shutter; only available when the shutter is closed

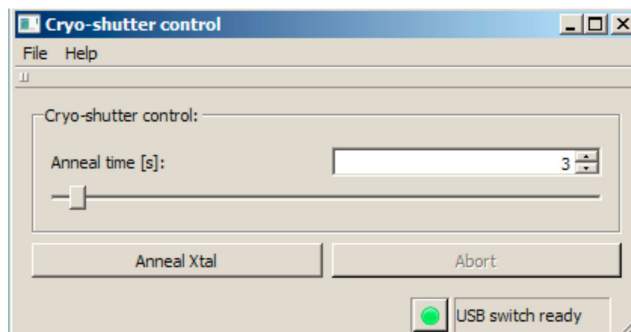


Fig. 5: Cryo-Shutter Control Software

### Reference

[1] Harp *et al.* (1999) Macromolecular crystal annealing: evaluation of techniques and variables. *Acta Cryst D55*:1329

### Copyright

The Cryo Shutter was developed by Dr. Uwe Müller, MX-Lab at BESSY-II, HZB Berlin-Adlershof.

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