ESLB and ESLB-X – Si(Li) Detectors for X-Ray or Beta Spectroscopy

Features

- Measurement of electrons from 20 keV to 3 MeV or x-rays up to 20 keV and even above with an increased detector thickness
- Thin entrance window: gold front entrance window with nominal thickness of 2000 angstrom equivalent Silicon
- Best performance through liquid nitrogen temperature operation
- Storage at room temperature
- Active thickness from 2 to 5 mm in standard and up to 10 mm on request
- Beta resolution from 1.6 keV to 1.8 keV at 624 keV
- Available with a cryostat as a turn key system (ESLB-X) or in kit form (ESLB)
- Position sensitivity possible through segmentation (see ESLX-S & LTS sheet)

Description

CANBERRA offers highly-reliable Silicon Lithium drifted detectors, cooled at cryogenic temperatures, for X-ray or conversion electron spectroscopy or beta decay exploration. Two configurations are available depending on the application. The ESLB is delivered with all components required for integration into an existing vacuum chamber. The ESLB-X comes with a complete cryostat and user friendly features to create a common vacuum between the cryostat and the experiment chamber.

ESLB Detector

ESLB detector consists of:

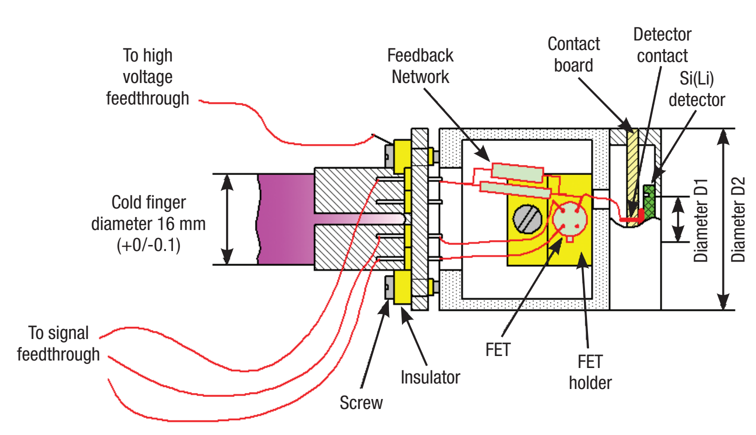
- Lithium drifted Silicon diode
- Aluminum mount including the diode and the first stage of the charge sensitive preamplifier (input FET, feedback network)
- Two feedthrough connectors (multipin and high voltage connectors)
- Charge sensitive preamplifier Model PSC761R with a 3.5 meter cable set

The detector is to be mounted on the cold finger of the cryostat (16 mm diameter). The remaining part of the resistive preamplifier is mounted outside the experiment chamber.

NOTE: The cryostat is not included in ESLB detectors; please use ESLB-X type if a complete cryostat is required.

Dimensions:

Active area (mm^2)	D1 (mm)	D2 (mm)
100	12	32
200	16	32
300	20	32
500	25	39



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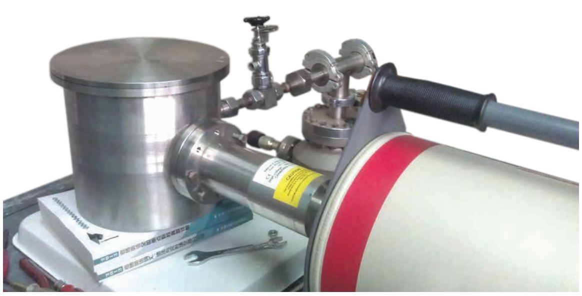
ESLB-X Detector

An ESLB-X is a complete detector system consisting of:

- Lithium drifted Silicon diode
- Flanged dipstick cryostat with horizontal output as a standard – additional cryostat configurations are available as an option
- Flange on the cap enables a vacuum connection on the customer's vacuum chamber
- The removable flange is equipped with a Be window for x-ray measurements
- Charge-sensitive preamplifier with a cold input stage and resistive feed-back network – an alarm card drives the bias shut down signal in case of incorrect temperature
- Set of cables (power supply – signal – high voltage)
- VOP10 vacuum operator to enable easy access to the cryostat vacuum

The ESLB-X detector is a ESLB detector embedded in a dedicated cryostat.



ESLB-X detector connected on a vacuum chamber. The ESLB-X is consisting of a portable slimline cryostat Big MAC type with a 7 liter Dewar.
By courtesy Dr. Wu – CIAE Beijing

Typical Cryostat Configurations

In standard, CANBERRA provides the horizontal flanged dipstick cryostat with a 30 liter Dewar Reference of the cryostat SH9030A.

Note that the CANBERRA Cryo-Pulse® 5 Plus electrical cooler can also be used on a ESLB-X detector.

Ask CANBERRA for additional information if LN_2 free solutions are required.

Also, gated valves are possible to replace the removable flange. This will significantly ease the handling of ESLB-X detectors. X-ray measurements are still possible through a Beryllium window on the valve. Typical Beryllium thickness 125 µm.

How to operate an ESLB-X detector

The ESLB-X detector can be used as a typical x-ray detector thanks to the Beryllium window. CANBERRA would recommend checking it this way just after delivery.

Measurement of electrons needs a windowless operation as described here. It is first required to completely warm up the detector to room temperature. It may require about three days once the Dewar is empty. Connect the VOP10 vacuum operator to the valve on the cryostat to open it. CANBERRA recommends a dry air, or if available, dry nitrogen gas inside the cryostat when slowly opening the valve. Once the inside is at atmospheric pressure, the removable flange on the cap can be removed.

The connection on the vacuum chamber of the experiment is then possible. Close the valve of the cryostat and remove the VOP10. Pump the complete cryostat through the vacuum chamber of the experiment with an oil-free cryogenic pump to provide at least a vacuum of 10^{-5} torr or better. Then the Dewar can be filled with LN_2 in order to cool down the Si(Li) detector. After a minimum of six hours waiting time to get steady conditions on the Si(Li) detector, the bias can be applied progressively.

To disconnect the detector, it first needs to be warmed up: empty the cryostat, and wait for three days until the detector warms up to room temperature. Break the vacuum of the chamber by letting dry air or nitrogen gas inside. Replace the flange on the cap. Connect the cryostat through the VOP10 to the pump to evacuate to a vacuum of at least 10^{-5} torr.

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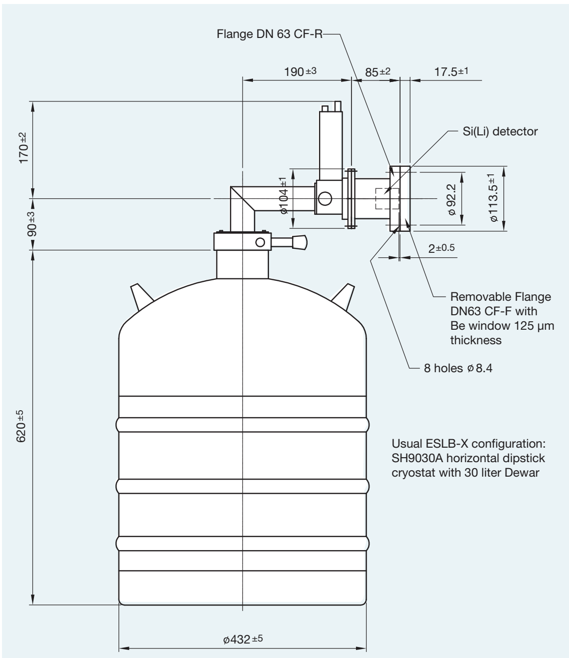
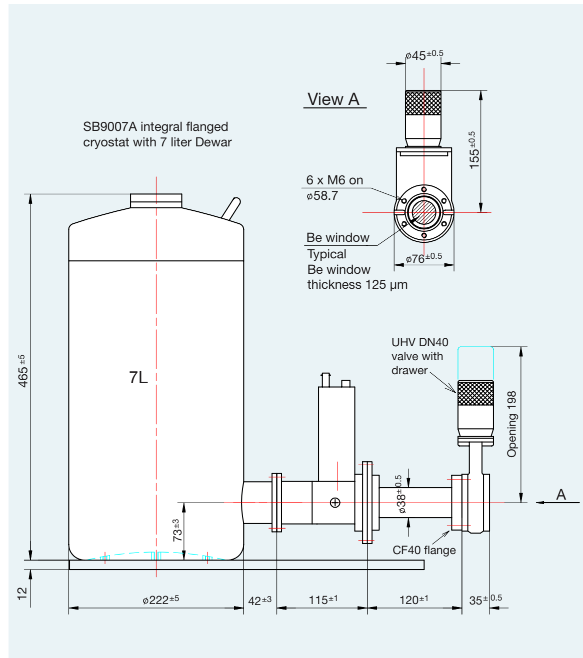
NOTE: all dimensions below are in mm and given only for information.





Recommendations

Because the Si(Li) detector is sensitive to light of any frequency, there must be no light leaks on the vacuum chamber of the experiment.

No outgasing at high temperature is possible with Si(Li) detectors to avoid drift of the Lithium. The pumping should only be performed at room temperature.

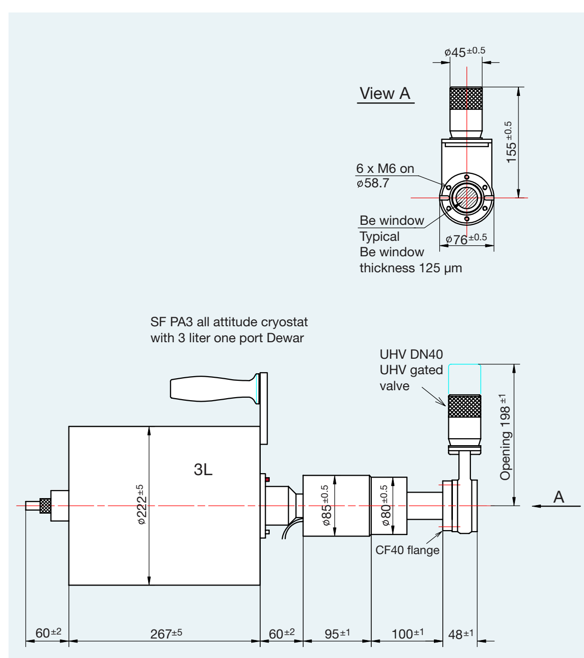
Be careful with the Beryllium window on the removable flange when dismounted.

Always avoid breaking the vacuum if the Si(Li) detector has not reached room temperature: the icing effect will cause irreparable damage to the detector.

Mechanical contact between the Si(Li) diode and any hardware should be avoided.

The UHV-vacuum-gated valve makes it possible to directly connect the cold detector to the vacuum chamber. This will avoid the time consuming warm up and cool down periods.

Please contact CANBERRA for any additional information.



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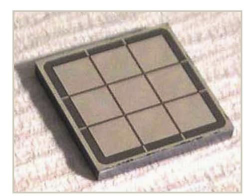
Specifications

ESLB

Thickness	2 mm		3 mm		4 mm		5 mm	
Active Area (mm²)	Beta FWHM at 624 keV (keV)	Model Number	Beta FWHM at 624 keV (keV)	Model Number	Beta FWHM at 624 keV (keV)	Model Number	Beta FWHM at 624 keV (keV)	Model Number
100	1.6	ESLB100-2000	1.6	ESLB100-3000	1.6	ESLB100-4000	1.6	ESLB100-5000
200	1.7	ESLB200-2000	1.7	ESLB200-3000	1.7	ESLB200-4000	1.7	ESLB200-5000
300	1.7	ESLB300-2000	1.7	ESLB300-3000	1.7	ESLB300-4000	1.7	ESLB300-5000
500	1.8	ESLB500-2000	1.8	ESLB500-3000	1.8	ESLB500-4000	1.8	ESLB500-5000

Maximum count rate: 300 000 c/s at 122 keV (for photons) – 100 000 c/s at 624 keV (for electrons).



CANBERRA uses photolithography techniques to Si(Li) diodes. Thus, all types of segmentation patterns are possible.

See also ESLX-S and LTS specification sheet for more information on segmented Si(Li) detectors.

ESLB-X

Active Area (mm²)	Active Thickness (µm)	Beta Resolution at 624 keV (keV)	X-ray Resolution at 5.9 keV (eV)	Model Reference
200	4000	1.7	360	ESLB-X 200-4000
	5000	1.7	360	ESLB-X 200-5000
300	4000	1.7	380	ESLB-X 300-4000
	5000	1.7	380	ESLB-X 300-5000
500	4000	1.8	460	ESLB-X 500-4000
	5000	1.8	460	ESLB-X 500-5000

Maximum count rate: 300 000 c/s at 122 keV (for photons) – 100 000 c/s at 624 keV (for electrons).

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