



# VACU TUBE and Vaccum pump

User manual  
09/2004



## Introduction

By deciding to join the flexible concept of SARAD VACU TUBE, you had ordered a versatile instrumentation fit for purpose in many fields of application for alpha spectroscopy. The unique design with open-top chamber enables beside the stepless adjustment of detector – probe distance the analysis of large samples too.

The remote Preamp / amplifier module AMP 01-03 with Micro-DOT connection allows the free usage of Si-detectors up to 70 mm in diameter (2000 mm<sup>2</sup>), i.e. wipe test analysis. In addition, the use of the detector unit for direct surface screening and surface contamination analysis is enabled.

The modular design of the VACU TUBE lead to the construction of single bench top units as well as multiple device use.

Ex work, the VACU TUBE is connected to a 400 mm<sup>2</sup> Si-detector, ask for assistance whether different detectors are required.

### 1. Vacuum techniques

#### 1.1 Vacuum pump

The VACU TUBE will be delivered for standard with a oil-less pump manufactured by ILMVAC. Please read carefully the manual of the manufacturer before usage.

The vacuum pump will be connected by quick lock connectors to the chamber using a 4 mm vacuum tube ( grey colour).

Insert the tube into the quick lock, the sealing will be provided automatically. To unlock the tube, press the blue ring / orange ring at the connector towards the instrument.

For field measurements, a 12 V, two head oil-less membrane pump is available on request.

#### 1.2 Vacuum control

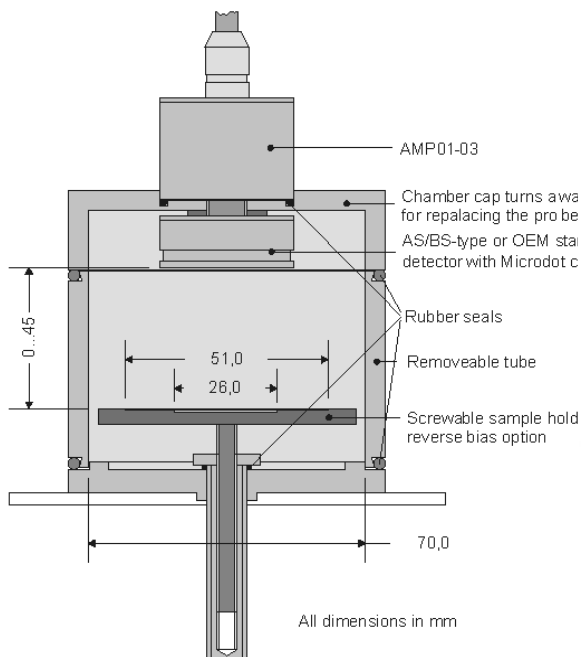
At the front panel of the vacuum tube, a valve is mounted to enable the following operation

PUMP	Connection chamber / pump is open, chamber will be evacuated.
CLOSE	Connection chamber / pump is closed, chamber is sealed.
AIR	Connection chamber / pump is closed, chamber will be flushed with air

In case of using multiple units of vacuum chamber, the connection will be provided using T-junctions inside the housing.

## 2. Chamber construction

All parts of the chamber are mounted vacuum tight or are equipped with best vacuum sealing. Please take care for a proper fitting of the sealing in case of putting the chamber together!



### 2.1 Sample holder

The sample holder is mounted inside the chamber. Please fix the holder in the appropriate level using the lower ring.

### 2.2 Vacuum chamber tube

Top and bottom of the vacuum tube is equipped with a sealing ring. Side are equal, therefore a misuse is impossible. Customised height of vacuum chamber tubes are available on request.

### 2.3 Detector holder, swivel arm

The swivel arm allows a horizontal and vertical movement of the detector unit. A unproper fitting of the top of the chamber is not possible, the damage of the sensitive detector surface is not able by just opening and closing the chamber.

To open the chamber, first flush the chamber as it will not be possible to move the top against vacuum pressure. Then lift the top and swivel horizontal away.

For closing the chamber, lift the top and place it exactly over the vacuum chamber tube. Do not move the top with contact to the sealing ring.

Press the chamber top by finger when beginning the evacuation by pump, it will seal automatically within the first seconds.

## 3. Detector / Amplifier unit

### 3.1 Preamp / Amp unit

Ex work, a SARAD AMP 01-03 will be used in the VACU TUBE. Connection to the detector unit will be provided by a vacuum sealed micro DOT socket.

### 3.2 Detector

The connection through the chambers top is sealed by a O-ring at the outer side of the top, take care for its correct fitting.

Screw in the detector to the AMP 01-03 by hand only! Use two flat washers to match the appropriate distance between the detector and the inner top of the chamber, otherwise the connection amplifier to

detector is too loose. It will seal at under pressure if you press the amplifier a bit together with the top, but using the washer will be a better choice. The detector / amplifier unit will seal automatically at under pressure.

Beside SARAD detectors other SI-barrier detectors like large area CAM PIPS detectors by CANBERRA match to the AMP 01-02. For technical information about the AMP 01-03, refer to the following pages.

### **3.3 Use of the detector unit for surface screening measurements**

Disconnect the detector / amplifier unit from the chambers top and reassemble them again by hand. Screw in the MICRODOT connection very carefully. Use the 1 meter detector cable connection for operation and plug in directly at the spectrometer unit.

Hint: The detector is light protected but not light tight! Avoid direct sun light. To protect the detector surface against mechanical damages, we recommend the use of a special collimator. In addition, this will increase the energy resolution of your measurement.

## **4. Cable connection of the VACU TUBE**

Please find a 5-pole socket at the rear panel of the VACU TUBE to connect the unit to the SPECTRA 50xx.

## **5. Electronic parts**

### **5.1 Reversed bias voltage**

To avoid a contamination of the SI-detector by attached progeny of the radioactive decay products of the rare gas Radon that might enter the chamber or will grow in during the measurement according the decay of Radium, a reversed bias voltage of  $-10\text{ V}$  will focus the for a short period of time positively charged decay products to the sample holder.

Correct bias supply is indicated by a red LED.

### **5.2 Control of vacuum pressure in the VACU TUBE**

The recent vacuum inside the chamber will be watched by the vacuum switch and displayed by a green LED. The LED will indicate a proper vacuum at an under-pressure limit of 150 mbar.

### **5.3 Power supply**

Power supply of the VACU TUBE will be done using a delivered wall plug in supply (220V/50Hz, output voltage 4,5 V). External power supply enable the LED display of vacuum status and the reversed bias control.

On outstanding advantage of the VACU TUB is that the major functions are available without any power supply, e.g. to hold the vacuum.

For information about the ILMVAC vacuum pump refer to the corresponding manual.

On request,

## **6 Battery operated field vacuum pump and field operation of the Vacu Tube**

On request, the VacuTube can be delivered together with a battery operated vacuum pump.

The power supply will be supported by a car battery plug with an output of 12 V. For laboratory use, a power supply with input AC/DC 220 V/ 50 Hz, output DC 12 V, stabilised will be delivered.

Any electronic motor as used inside the vacuum pump will create an electronic field during use and emit electromagnetic waves of different frequencies.

Although our battery operated vacuum pump is best shielded, it still may cause impulses during the acquisition of an alpha spectrum.

Place the pump close to the detector module and start a measurement with the pump running: A certain number of "beta impulses" will appear.

To prevent your measurement against such influences, place the pump as far away from the detector module, the vacuum tube is long enough.

Hint:

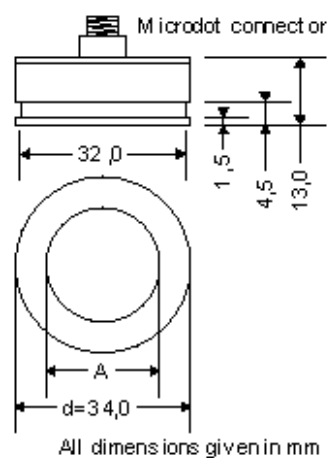
A good solution is as well to evacuate the chamber, seal the chamber and stop the pump. The vacuum will last inside the chamber for a very long time (more than two days!)

Hint:

In case that no power is available, it is of course possible to evacuate the chamber using a syringe or a hand vacuum pump (i.e. delivered by NALGENE).

During field operation, no power is needed to operate the VacuTube. Remember: There will be no indication of vacuum nor will be a reversed bias supply.

## Silicon ion-implanted detectors AS/BS-type for Alpha and Beta detection R-400 E/V



### Features

- Easy to clean
- Light protected
- High depletion depth at low bias voltages
- On air and vacuum operation
- Ni-plated brass cover with Microdot™ connector

### Applications

- Alpha/Beta counting/spectroscopy

### Matches with

- AMP 01-03 (direct screwing), OEM-standard preamplifier
- SARAD VACU-TUBE chamber

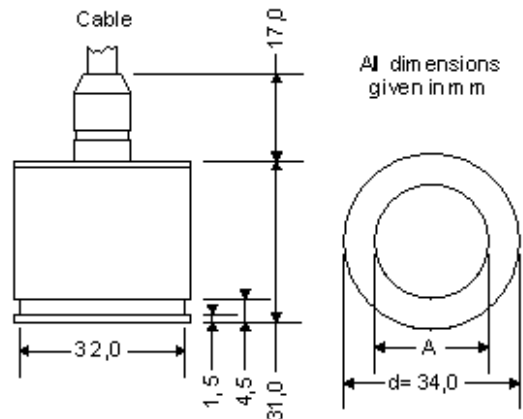
### Technical parameters

Model	Entrance window [mm]	Active Area [mm <sup>2</sup> ]	Beta resolution [keV]	Depletion depth [μm]	Protection layer (Al) [μm]
AS 150/E	14	154	15	>100	50
AS 400/E	22	380	25	>100	50
BS 400/E	22	380	25	>500	50

Recommended BIAS voltages:

- AS-type: 15/35V
- BS-type: 70/100V

## Preamplifier/Amplifier module AMP 01-03



### Features

- Low cost – High performance
- Direct connection of any standard-detector with Microdot™ connector
- Gauss shaped pulse output
- Saves space
- Low power – Low voltage

### Technical Data

Bias voltage range: 0...50V

Beta resolution: 100pF

200pF

1000pF

Time to peak: 5μs

Total peak width: 12μs

Output signal: approx. 200mV/MeV

Connection: cable with or without (OEM) 5-pin plug

### Applications

- Replacement of NIM-standard components
- OEM applications
- Using of large area standard detectors with SARAD equipment

### Matches with

- SPECTRA 5011/5031/5041
- SCA6030
- SARAD detector series (70 /150 / 400 mm<sup>2</sup>)
- Standard OEM detector (i.e. PIPS)
- SARAD VACU-TUBE chamber

<b>Alpha in situ + vacuum</b>	<ul style="list-style-type: none"> <li>• SPECTRA 5011</li> <li>• AS-400 mm<sup>2</sup> type detector (up to 2000 mm<sup>2</sup>)</li> <li>• AMP 01-03 (remote preamp)</li> <li>• VACU-TUBE vacuum chamber</li> <li>• Printer port adapter</li> <li>• Control and Alpha analysis software</li> </ul>	<ul style="list-style-type: none"> <li>• Filters from air samplers</li> <li>• Smear tests</li> <li>• Surface screening</li> <li>• RaDISC-Analysis</li> <li>• Radiochemical prepared samples</li> </ul>
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### Application

- Geological survey
- Radiological laboratories
- Environmental observation
- Oil industry (NORM/TENORM)
- Waste management (Scrap and scale monitoring)
- In situ measurements
- Surface screening
- Smear samples
- Water analysis
- Dust analysis (using with air samplers)