

TRITIUM SURFACE CONTAMINATION MONITOR**CONTENTS**

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1. SAMPLE**1.1. TYPE OF RADIATION MEASURED : TRITIUM - BETA PARTICLES**

System efficiency : 85% - typical

Spectrum : continuous

Maximum energy of most abundant β -transition : 20 keV**1.2. DETECTION LIMITS AND MEASURING RANGES – THEORETICAL APPROACH**

Formulae and calculations without presence of radon i.e. theoretical approach, specified from monitor inlet

$$\text{DETECTION LIMIT [cps]} = 2 \times \sqrt{\frac{R_0}{T}}$$

with : T = Measuring time = Sampling time [s]

R₀ = Background = 1 cps - typical2 = statistical safety : 2 σ

DETECTION LIMIT (PHYSICAL UNITS) = Detection limit x Calibration factor

Calibration factor point source :

2.2 Bq/cps
6 x 10⁻⁵ μ Ci/cps

Calibration factor area source : (with window completely open)

0.1 Bq/cm² per cps
2.7 x 10⁻⁶ μ Ci/cps

Calibration factor area source : (with aperture plate exceeding the size of the window opening)

1 Bq/cm² per cps
2.7 x 10⁻⁵ μ Ci/cps

(Calibration factors for an H-3 source free of self-absorption)

Maximum of range calculated as : R_{sat} x CALIBRATION FACTORwith : R_{sat} = Maximum (saturation) count rate = 5 x 10⁴ cps - typical at 20% dead-time loss

Point source

Maximum of range :
1.1 x 10⁵ Bq

Meas. time [s]	Det. limit [cps]	Det. Limit [Bq]
5	0,894	1,968
10	0,632	1,391
60	0,258	0,568
200	0,141	0,311

Area source (open)

Maximum of range :
5 x 10³ Bq/cm²

Meas. time [s]	Det. limit [cps]	Det. limit [Bq/cm ²]
5	0,894	0,089
10	0,632	0,063
60	0,258	0,026
200	0,141	0,014

Area source (plate)

Maximum of range :
5 x 10⁴ Bq/cm²

Meas. time [s]	Det. limit [cps]	Det. limit [Bq/cm ²]
5	0,894	0,894
10	0,632	0,632
60	0,258	0,258
200	0,141	0,141

2. DETECTOR

2.1. DESIGNATION : LB 1239

Type : Flow-through windowless proportional counter tube
Detecting tritium on plane surfaces
Counter tube aperture : 150 x 15mm with 3 parallel counting wires over the entire aperture area
Effective area : 22cm² (150mm x 15mm)
Height counting chamber : 5mm
Electrical termination : 5 thin cathode wires
Mechanical enclosure : fine mesh nylon grid providing dust protection
Distance to surface to be monitored : 2mm (via 4 spacers)
System efficiency : 85% - typical
Background : 1 cps - typical
Gas consumption : 2000 cm³/min
Detector fixation on console : tapered bar and resilient pivots
Hardware integrated in detector housing : high voltage and preamplifier

2.2. COUNTING GAS SUPPLY

Counting gas : P-10 (gas mixture consisting of 90% Argon and 10% Methane) in 3-liter cylinder
Air flow components : cylinder valve, double pressure reducer and rotameter
Tubing : transparent PVC
Internal diameter : 5mm
Rotameter range gas flow : 0 - 3000 cm³/min
Setpoint : 2000 cm³/min (scale of rotameter x 10)
Cylinder fixation on trolley : holding device with straps

3. ELECTRONICS

Designation basic unit : LB 1230

Results display :

- ▶ High contrast dot matrix display with 32 84 pixels
- ▶ Background illumination can be turned off
- ▶ 4 digits numerical values with floating decimal point and automatic prefix switchover when changing a range

Operating elements : Membrane keypad comprising 1 ON/OFF button and 4 softkeys

Detector connection :

- ▶ 8-pin connector socket Fischer+- standard cable LB 75576
- ▶ Interface LB 75306 as standard

Data output : FSMA connector, via beam waveguide and gear waveguide interface LB75306 with 25D connector

Fixation on console : knurled screws into cradle

4. ENCLOSURES

4.1. BASIC UNIT

Dimensions : 145 x 170 x 45 (H x W x D) mm

Weight : approx. 800g (with batteries)

4.2. WALL BRACKET

Designation : LB 1250

Dimensions : 68 x 245 x 77 (H x W x D) mm

Low voltage power supply : +5.8V via mains adapter LB 7619

4.3. TRANSPORT CASE

Dimensions : 180 x 450 x 350 (H x W x D) mm

4.4. TROLLEY

Dimensions : 1000 x 430 x 330 (H x W x D) mm

5. AMBIENT**5.1. BASIC UNIT**

Temperature range : -15°C to +50°C
Enclosure : IP40

5.2. DETECTOR LB 1239

Temperature range : -10°C to +50°C
Enclosure : IP20

6. MAINS

Basic unit : 3 x IEC-R14 (baby cell) or 3 x rechargeable cells e.g. Varta NiCd #5014

7. OPTIONS**7.1. APERTURE PLATE**

To measured fingertips or hot spots, an aperture plate can be mounted on the detector. The detector plate is magnetically held in position.
Gas consumption : 1000 cm³/min

7.2. BETA - GAMMA PROBE LB 1231

For extending the range of applications which can also be mounted on the trolley and alternatively connected to the UMo
Type : Sealed proportional counter tube
Counting gas : Xenon
Window area : 120mm x 190mm²
Window foil : 5mg/cm² Titan
Background : 15cps - typical
Efficiency (including protection grid) :
C-14 : 3.6%
Sr-90 : 30%
Am-241 : 11% (measurement via 59keV quanta)

Fixation : circular-holding device on trolley
Temperature range : -15°C to +50°C

7.3. ALPHA - GAMMA PROBE LB 1232

For extending the range of applications which can also be mounted on the trolley and alternatively connected to the UMo
Type : Filled proportional counter tube
Counting gas : Butane
Window area : 120mm x 190mm²
Window foil : 0.4mg/cm²
Efficiency (including protection grid) :
C-14 : 17%
Sr-90 : 34%
Am-241 : 14%

Fixation : circular-holding device on trolley
Temperature range : +5°C to +30°C

7.4. H-3 CALIBRATION SOURCE

Designation : TRR 16161
Activity : approx. 10kBq
Efficiency : 85% of the emitted particles