



**LB 110**  
Tritium Monitor

# LB 110

## Tritium Monitor

### Equipment Concept

Tritium ( $^3\text{H}$ ) in air is mostly available in the form of water vapor ( $\text{H}_1\text{H}_3\text{O}$ ) or gaseous hydrogen ( $\text{H}_1\text{H}_3$ ). Since the Beta particles emitted by Tritium have a very short range (only a few millimeters in air), windowless counter tubes must be used, i.e. the air to be measured has to be added to the counting gas. For a continuous measurement, the counter tube must therefore operate in the flow-through mode.

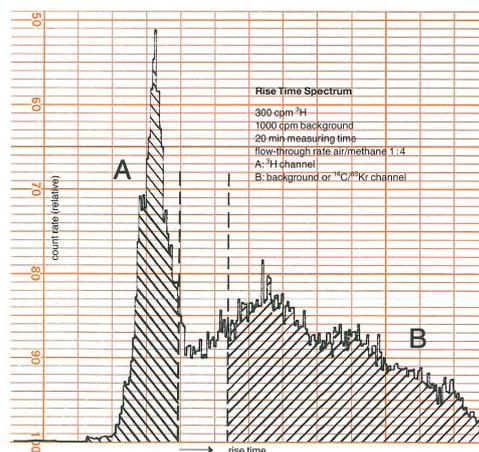
The air to be measured is mixed with a suitable counting gas and passed through a 1.3 liter volume proportional counter tube. Methane (mixing ratio air/gas 1:3) or Argon-Methane (P10, mixing ratio air/gas 1:4) are used as counting gas.

The distinction of Tritium pulses from those of other nuclides or from Gamma radiation – and hence the Tritium -specific measurement – is carried out using the pulse rise discrimination method, which offers major benefits as compared to the earlier used range discrimination (F. Berthold, Tritium-in-Air Measurements by Pulse Shape Discrimination Methods, in: Radiation-Risk-Protection Vol. III, Pages 1091 - 1094, FS-84-35 T, Verlag TÜV Rheinland, Köln 1984). This method yields better response sensitivity data, relative to the same gas consumption.

Rise time discrimination is based on the fact that the rise time in proportional counter tubes is dependent on differences in the drift time that electrons occurring in the primary ionization track need to get in the vicinity of counting wires. These drift time differences are dependent on the length and the course of the primary ionization track. In the case of Tritium, this track – due to the low particle energy – has to be regarded as point-shaped in contrast to the long ionization tracks caused by high-energy Beta or Gamma sources.



LB 110

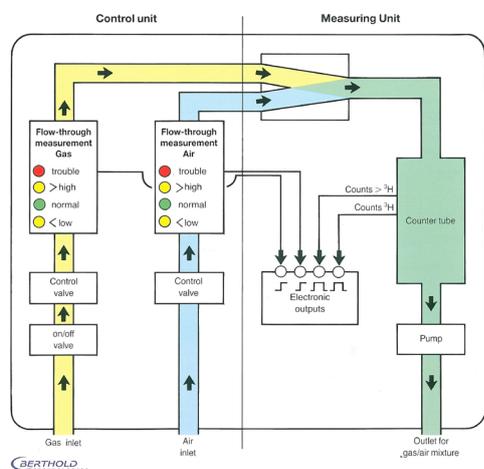


Typical rise time spectrum

## Counting Gas Control

The accuracy of the measurement is dependent on the constancy of the mixing ratio of air and counting gas. Due to that the LB 110 ensures a good and reliable gas-air control. Measuring air and counting gas flow are measured separately and kept at a constant level via a control circuit. The current gas and air flow rate is measured using an electronically controlled flow-through meter which operates according to the principle of thermal mass measurement.

An essential benefit of this principle is that the measurement is largely independent of pressure and temperature. Compared to volumetric principles, neither pressure nor temperature has to be measured in addition. The electronics integrated into the air and gas module is used to control and evaluate the signals modified by the flow-through controller. Gas and air supply are measured separately and kept on a constant level by one control circuit each.



Counting gas control



LB 9000 Data Logger

## Evaluation Electronics

There are two evaluation units for the LB 110 Tritium Monitor: The data logger LB 5340 or LB 9000.

Due to the modular design the LB 5340 and LB 9000 can be equipped, corresponding to the application needed, with different probes, sensors and peripherals by means of modules. The usage of up to 6 different modules enables to configure a large measuring system. The system processes the module control, calculation of all measuring results, as well as balancing.

The measured values and graphics in the LB 5340 are shown by means of different depictions in pre-defined screen pages. The LB 9000 offers the possibility to configure up to 8 different screen pages individually with different measurement values, status signals and graphics. Optionally, it is possible to set up and perform system-specific routines for periodical tests via an additional software module. Such routines can be completed with a periodical testing report. For more information please refer to the LB 5340 and LB 9000 Data Logger product information.



LB 5340 Data Logger

# Product Information

## LB 110 Tritium Monitor

### Mechanical Data

<b>Counter Tube LB 6225</b>	
Dimensions	430 x Ø 80 mm <sup>3</sup>
Active Volume	1,3 l
<b>Device LB 110</b>	
Dimensions (L x W x H)	500 x 420 x 335 mm <sup>3</sup>
Weight	approx. 20 kg

### Technical Data

Counting gas	Methan	P10
Air-counting gas-Mixture	1:3	1:4
Flow rate l / min	0,25 : 0,75l	0,2 : 0,8l
Measuring air contents in the counter tube	0,325l	0,26l
Efficiency <sup>3</sup> H approx.	ca. 60%	ca. 55%
Calibration factor <sup>3</sup> H (kBq/m <sup>3</sup> /cps)	5,1	7,0
Background in <sup>3</sup> H channel	< 3 cps	
Measuring range	500 Bq/m <sup>3</sup> - 20 MBq/m <sup>3</sup>	
Spillover <sup>137</sup> Cs in <sup>3</sup> H channel	< 10%	
Spillover <sup>85</sup> Kr in <sup>3</sup> H channel	3 – 5%	
Spillover <sup>14</sup> C in <sup>3</sup> H channel	23 – 25%	

### Typ. Detection Limits according to ISO 11929

At a background of 1 cps

Measuring time	kBq/m <sup>3</sup>	kBq/m <sup>3</sup>
30s	3,6	5,0
60s	2,5	3,4
600s	0,7	1,0
1h	0,2	0,4
24h	0,08	0,1

### Gas- and Air Connections

Gas	Ø 7 mm
Measuring air	Ø 7 mm
Outlet for gas-air mixture	Ø 7 mm

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### Power Supply

Voltage	230 VAC 50 Hz or 115 VAC 60 Hz
Power consumption	Max. 40 W
Fuses	230 VAC: 0,5 A, T / 115 VAC: 1 A, T

### Heating Supply (optional)

Voltage	230 VAC 50 Hz or 115 VAC 60 Hz
Power consumption	Max. 82 W
Fuses	230 VAC: 2 A, T / 115 VAC: 3,15 A, T
Heating controller (front panel fuse)	230 V / 0,315 A, T

### Ambient Conditions

Operating temperature	0°C to 50°C
Relative humidity	0 to 90%, no condensation
Protection degree (according to DIN IEC 60529)	IP32 in desktop housing

### Order Information and Accessories

LB 110-1 230V	80872-10
LB 110-3 115V	80872-20
LB 110-1 230V with heating	80872-11
LB 110-3 115V with heating	80872-21
LB 5340-5 Data Logger	54000-05
LB 9000 Data Logger 230V	42836-12
LB 9000 Data Logger 115V	42836-21

This instrument is not intended to be used for diagnostic and/or therapeutic purposes for human beings and is not a medical device – according to the definitions of the European Council Directive 93/42/EEC concerning medical devices.