LB 110
Tritium Monitor
Tritium (\(^3\)H) in air is mostly available in the form of water vapor (H\(_2\)O) or gaseous hydrogen (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.
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.

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.
Product Information

LB 110 Tritium Monitor

Mechanical Data

Counter Tube LB 6225
Dimensions 430 x Ø 80 mm³
Active Volume 1,3 l

Device LB 110
Dimensions (L x W x H) 500 x 420 x 335 mm³
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 ³H approx. ca. 60% ca. 55%
Calibration factor ³H (kBq/m³/cps) 5,1 7,0
Background in ³H channel < 3 cps
Measuring range 500 Bq/m³ - 20 MBq/m³
Spillover ¹³⁷Cs in ³H channel < 10%
Spillover ⁸⁵Kr in ³H channel 3 – 5%
Spillover ¹⁴C in ³H channel 23 – 25%

Typ. Detection Limits according to ISO 11929
At a background of 1 cps
Measuring time kBq/m³ kBq/m³
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

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 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

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<th>Part No.</th>
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<tr>
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<td>80872-10</td>
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<td>LB 110-3 115V</td>
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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.