BERTHOLD TECHNOLOGIES

Betriebsanleitung
Operating Manual

Contamination Monitor

LB 1210 B / C

80117BA2 Rev.00

Diese Geräte sind nicht für den Betrieb in explosionsgefährdeten Bereichen bestimmt!

Die gelieferten Geräte dürfen nur vom Service der Firma Berthold oder durch von der Firma Berthold autorisierte Techniker instand gesetzt werden!

These units are not designed for use in hazardous areas.

The units supplied should not be repaired by anyone other than Berthold service engineers or technicians authorized by Berthold.

Im Störungsfall wenden Sie sich bitte an unseren zentralen Kundendienst.

In case of operation trouble, please address to our central service department.

BERTHOLD TECHNOLOGIES

BERTHOLD TECHNOLOGIES GmbH & Co. KG
Calmbacher Straße 22
75323 Bad Wildbad-Germany
www.Berthold.com

Phone +49 7081 177-0
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info@Berthold.com

Confirmation on Decontamination

If you return an instrument to us for servicing purposes which is not properly decontaminated, there will be a health risk for BERTHOLD TECHNOLOGIES employees. We therefore need your confirmation that the instrument was decontaminated and cleaned properly before shipping. If the form below is not filled in accordingly and completely, we will reject the instrument. This is needed to protect our employees. We kindly ask you for your understanding.

Instrument / component	Serial no.
_____	_____

Instrument or component has come into contact with:

[ ] radioactive substances	How decontaminated / cleaned:
Isotope_____	_____
_____	_____
[ ] chemical reagents	How decontaminated / cleaned:
R-and S-rules _____	_____
_____	_____
[ ] biological material	How decontaminated / cleaned:
specifiy _____	_____
_____	_____
[ ] contagious agents	How decontaminated / cleaned:
specify _____	_____
_____	_____

[ ] I hereby confirm that the instrument or component specified above was not contaminated with any of the above mentioned substances / reagents / agents

[ ] I hereby confirm that the instrument or component specified above was decontaminated / cleansed using the appropriate method

Date:_____ signature: _____

(please print!)	address:
name:_____	_____
_____	_____
title:	_____
_____	phone:_____
	fax:_____

DC00002DV2 Rev.04

BERTHOLD TECHNOLOGIES GmbH & Co. KG
P.O. Box 10 01 63 • D-75312 Bad Wildbad -
Germany

Bad Wildbad, July 2002

NEW SAFETY REGULATIONS FOR SERVICING LABORATORY INSTRUMENTS

Dear Customer,

For instruments used in bioanalytical laboratories it cannot be ruled out that service personnel could be exposed to health risks by coming into contact with residues of hazardous substances, especially when the instrument has been used for making measurements using radioactive, infectious or toxic substances.

The current regulations and laws, as well as the extended guidelines and norms, stipulate that we, as a manufacturer of measuring systems, observe more stringent safety regulations in order to ensure the safety of our employees. These regulations and laws include:

- The chemicals ordinance for protection from hazardous substances
- The hazardous substances ordinance, technical rules for hazardous substances
- The radiological protection ordinance
- The accident prevention regulations biotechnology, safety tests concerning biological safety according to UVV, VBG 102
- The guidelines of the professional associations, working in contaminated areas

Moreover, the environmental regulations issued by the environmental protection and industrial inspection board as well as the quality assurance system DIN/ISO 9001, which was awarded to Berthold in 1990, also have to be observed.

Therefore, prior to allowing any repair work in your laboratory or before returning the instrument to us we would ask you, **either** to carefully clean, disinfect or decontaminate the instrument or components to be serviced, **or** confirm that the instrument or components have not come into contact with any hazardous substances.

The enclosed „Confirmation on Decontamination" should be filled out and attached to the shipping papers together with your repair order, or handed out directly to our service technicians in your laboratory.

We are unable to commence repair work without a declaration that the instrument has been decontaminated. Should the declaration not be received within three weeks we regret that we must for safety reasons return the instrument unrepaired, at your cost.

For radiation protection instruments and detectors returned without a decontamination declaration we offer to test for radioactive contamination for 50 Euro.

For further questions, please do not hesitate to contact us directly:

BERTHOLD TECHNOLOGIES GmbH & Co. KG
Service Department
Calmbacher Straße 22
D-75323 Bad Wildbad
Germany

Phone: +49 7081 177-111
Fax: +49 7081 177-339
Email: Service@BertholdTech.com

Yours sincerely

BERTHOLD TECHNOLOGIES GmbH & Co. KG

Hans Oberhofer
General Manager

The β-γ-Contamination Monitor LB 1210 B . . .

Contamination checks have in recent years been recognized world-wide as being essential for efficient radiation protection. This is why in 1977 Berthold introduced a sealed large-area proportional counter tube specifically for this application. It was the first practical large-area counter tube without cumbersome counting gas supply.

With xenon as counting gas, this sealed counter tube is capable of detecting low-energy photon emitters, such as ^{125}I, with high sensitivity.
The Contamination Monitor LB 1210 B incorporates such a xenon counter tube.
This has established it as a standard monitor for radionuclide laboratories and nuclear medicine applications.

. . . Your companion at work in the Laboratory

Measure

You can even accurately measure the **contamination level.** The Contamination Monitor LB 1210 B indicates contaminations in the internationally standardised count-rate (s^{-1}), i.e. in counts per second.
A table we have prepared makes it easy for you to convert these count rates into activity per unit of area. For such conversions the calibration data are marked directly underneath the monitor.

Calibration data of LB 1210 B

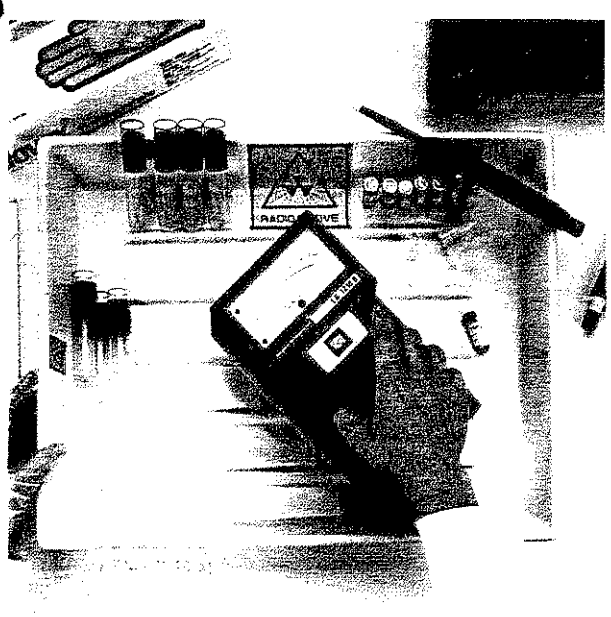
Isotope	1 s^{-1} *) per		Threshold setting *)
	Bq · cm^{-2}	10^{-4} µCi/cm^2	3.7 Bq · cm^{-2} (10^{-4} µCi/cm^2)
^{14}C	0.2	0.05	20 s^{-1}
^{60}Co	0.07	0.02	50 s^{-1}
^{99m}Tc	0.3	0.08	13 s^{-1}
^{125}I	0.3	0.08	13 s^{-1}
^{131}I	0.04	0.01	100 s^{-1}
^{241}Am	0.3	0.08	13 s^{-1}

*) Countrate above background

Localisation

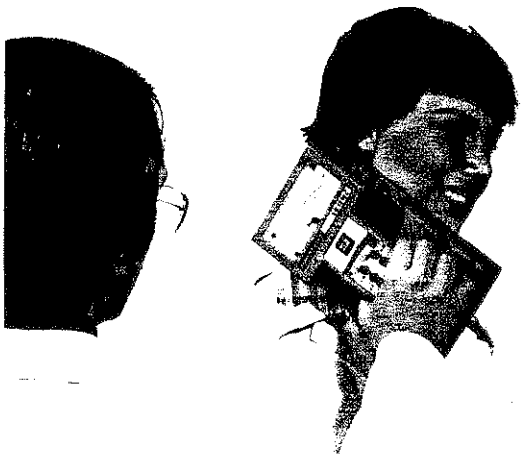
The Contamination Monitor LB 1210 B is always available and ready to use.
When working with exposed radioactive substances, your LB 1210 B can detect contaminations at any time. You can take an instant reading and, if you wish, even hear **where** the contamination is located . . .

. . . . . on the hand
. . . . on the equipment
. . . . . on the table top
. . . . or on the clothing.



Work place survey with the contamination monitor

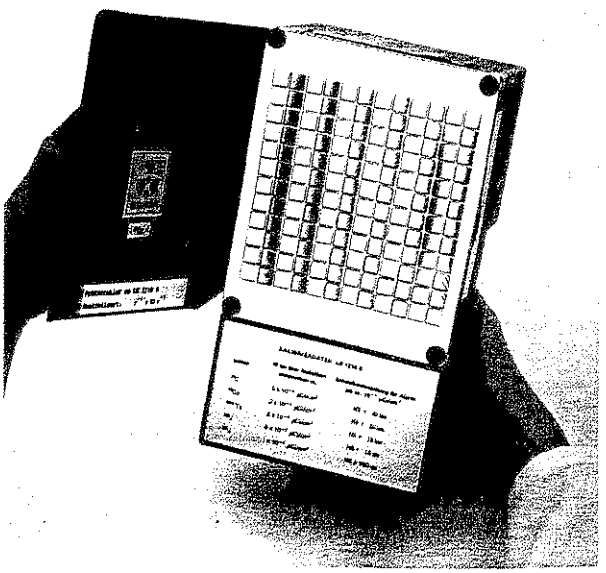
Even Assessment of Incorporation!



Jodine burdens of the thyroid, by ^{125}I as well as by ^{131}I, can be assessed with the LB 1210 B simply and timely far below the limit values.

Check

The performance check of your Contamination Monitor is another thing we have made easier for you.
Because Section 72 of the German Radiation Protection Act demands regular performance checks.
The protective cap of the counter tube contains a reference source. No licence is required for this reference source.
The reading which must be obtained when the monitor is functioning normally is marked near the reference source.

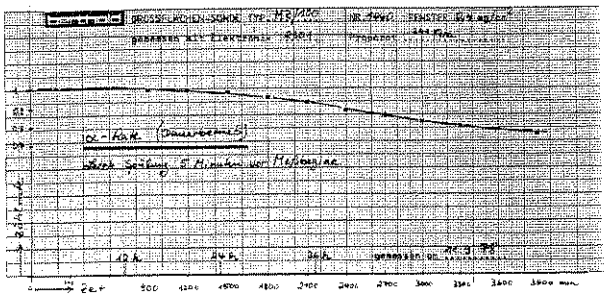


Removing the protective cap with built-in reference source.

The α/β Contamination Monitor LB 1210 C

Xenon counter tubes are quite capable of detecting many α-emitting radionuclides through their accompanying low-energy photon radiation. The monitor LB 1210 B, for example, has practically the same sensitivity to ^{241}Am as it has to ^{125}I. For maximum sensitivity of α measurements, however, Berthold have developed the α/β Contamination Monitor LB 1210 C. The LB 1210 C has a liquid gas filled counter tube, and the weight of the counter tube window is only 0.4 mg/cm^2. This gives the Monitor LB 1210 C the unusually high efficiency of 22 % for 2-dimensional α emitters (^{241}Am). One liquid gas filling of the counter tube lasts for at least 12 hours, but usually far longer.

Long-time stability of the α/β Monitor LB 1210 C with one single filling



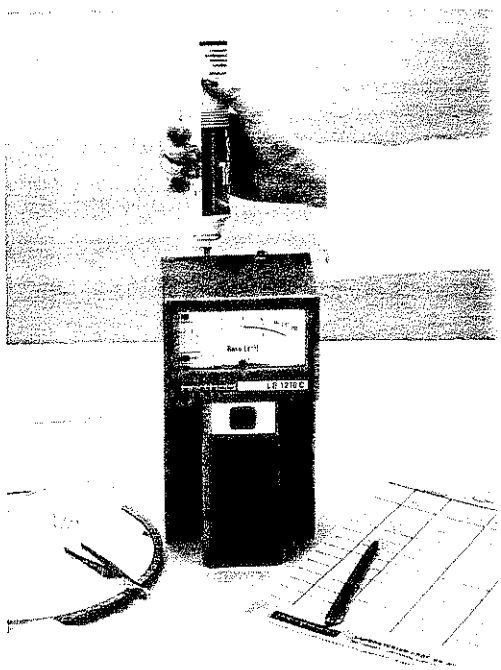
The long-time stability of the Monitor LB 1210 C with one single counter tube filling is excellent. Even 48 hours after filling the reading has fallen by less than 20 % of its initial value.

Calibration data of the α/β Monitor LB 1210 C

Isotope	1 s^{-1} *) per		Threshold setting *)
	Bq · cm^{-2}	10^{-6} µCi/cm^2	3.7 Bq · cm^{-2} (10^{-6} µCi/cm^2)
^{14}C	0.04	0.01	80 s^{-1}
^{60}Co	0.04	0.01	100 s^{-1}
^{90}Sr-^{90}Y	0.015	0.004	280 s^{-1}
^{241}Am	0.04	0.01	80 s^{-1}

*) Countrate above background

Filling the α/β Monitor LB 1210 C with counting gas



Filling the counter tube LB 1210 C at the start is as simple as that.

Technical Data

β-γ-Monitor LB 1210 B

Detector:
Xenon-filled proportional counter tube BZ 100 XE-P with particularly high sensitivity for ^{125}I. Window dimensions 112 mm x 112 mm, 100 cm^2 effective area. Foil material Titanium, area weight 5 mg/cm^2. Plugged into the bottom face of the ratemeter unit. Background countrate appr. 8 cps.

High Voltage:	fixed appr. 1900 V, internally adjustable ± 200 V
Measuring Ranges:	0-300 cps on a quasi-logarithmic scale x 1 and x 10 by push-button · Operation on higher range is indicated by LED display on scale · Scale length 75 mm
Time Constant:	2 sec · x 10 by push-button
Single Pulse Indication:	acoustically · On/Off by push-button
Alarm Threshold:	adjustable over full scale length · Indication of setting on instrument by push-button · Acoustical signaling of surpassing
Weight and Dimensions:	220 mm x 123 mm x 92 mm, weight ca. 1600 g.
Colour:	Orange
Connection of external probes:	by means of an adaption unit which is plugged into the place of the attached detector probe.

α-β-Monitor LB 1210 C

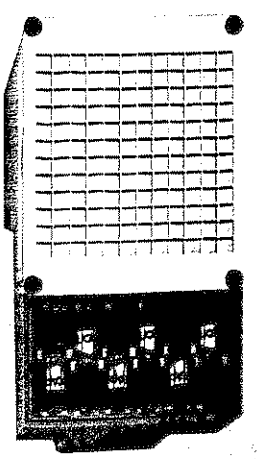
Detector:

Proportional counter tube MZ 100 for operating with liquid fuel (Ronson lighter fuel) as counting gas · window dimensions as BZ 100 XE-P, foil material aluminium-coated plastic with 0.4 mg/cm^2 thickness · plugged into the bottom face of the ratemeter unit · background count rate for α + β measurements ca. 5 cps.

High Voltage:	α range fixed appr. 2400 V, β range appr. 3400 V, both voltages internally adjustable ± 200 V. Voltage selection by push-button.
Measuring Ranges:	0-30 s^{-1} in addition to LB 1210 B ranges.
Colour:	Yellow
All other features:	like LB 1210 B

Battery supply

The 6 round miniature cells (1,5 V No. 7244, IEC-No. LR 03) will last for at least 72 hours of continuous operation. A flashing light automatically indicates when the batteries are nearing exhaustion - an additional safety feature so far only offered by the LB 1210! An optional external charging unit allows the batteries to be replaced by rechargeable cells.



The battery compartment cover can easily be opened without special tools.

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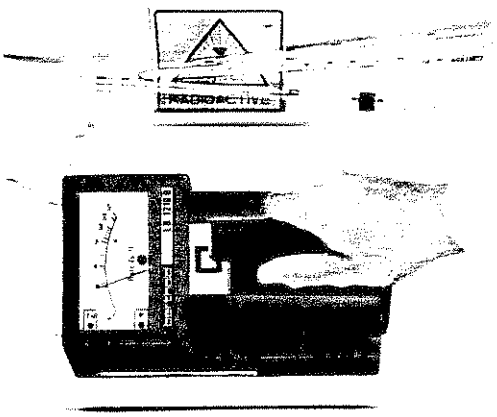
LABORATORIUM PROF. DR. BERTHOLD, D-7547 Wildbad 1, Calmbacher Str. 22, P. O. B. 160, Phone (07081) 3981, Telex 724019

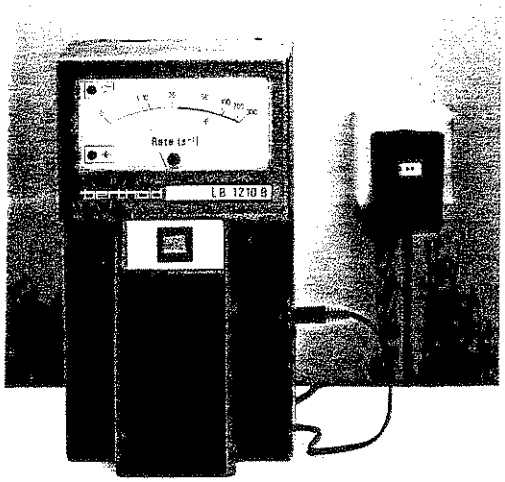
Accessories for Contamination Monitor LB 1210

Optional accessories make handling even easier and widen the range of applications.

The **„small" wall bracket** provides a handy "parking space" for the Contamination Monitor LB 1210 and makes it always ready for use at operator working positions. Finger contaminations, for example, can now be checked without touching the monitor or removing it from its mounting.



Whoever uses the instrument a great deal or frequently has to check large areas will appreciate the additional convenience offered by the optional **screw-on handle.**



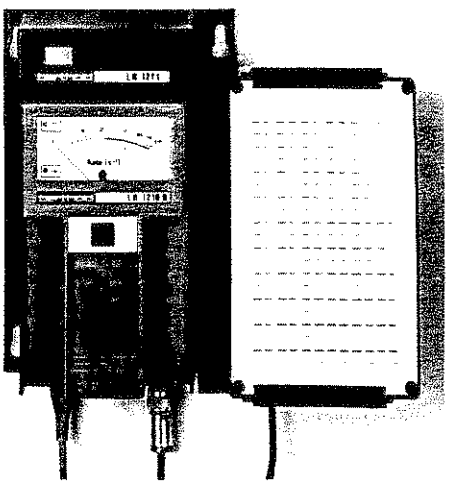
The **basic mains supply unit LB 7616** protects the batteries when the monitor is left on permanently at working positions. Particularly recommended in conjunction with the small wall bracket.

Wider applications and connecting external probes

Special counter tubes are available for measuring large-area contaminations and for tritium measurements. They are connected through an adaptor.

When placed on the **trolley** the Contamination Monitor LB 1210 B is within seconds converted into a floor monitor.

For extended floor areas we recommend replacing the standard counter tube in the Contamination Monitor LB 1210 B by the larger probe BZ 200 XK-P together with the **lead shield and adaptor**.



In conjunction with the **wall bracket and power supply unit LB 1211** and the interchangeable optional probe BZ 200 XK-P the LB 1210 B becomes a simple stationary exit monitor for checking hands and clothing when leaving the controlled zone.

For ^{3}**H contamination checks** a special windowless counter tube is available which can also be connected to the monitor LB 1210 B. If tritium is your problem, we will be pleased to advise you.

If you would like to order one of the options shown, please quote the following references:

· Screw-on handle	ZN 1650.160
· Small wall bracket	ZN 1650.170
* Mains supply unit	LB 7616
Large wall bracket for monitor and optional probe, with built-in power supply unit	LB 1211
Trolley	ZN 1650.500
Lead shield and trolley adaptor	ZN 1650.510
External probe with 200 cm² effective window area	BZ 200 XK-P

* included in the scope of our delivery

. . . essential for the radionuclide laboratory !

About contamination limits

To begin with, there is the German Radiation Protection Act of 16. 10. 1976. Section 64 (3) in conjunction with Appendix IX of this Act lays down **contamination limits.** For β and γ emitting radionuclides these are 37 Bq x cm^{-2} (10^{-3} $\mu Ci/cm^2$) in controlled areas, 3.7 Bq x cm^{-2} (10^{-4} $\mu Ci/cm^2$) in monitored areas and 0.37 Bq x cm^{-2} (10^{-5} $\mu Ci/cm^2$) outside areas subject to radiation monitoring.
These figures represent the **mean over 100 cm^2** of surfaces, objects and clothing.
In accordance with Section 64 (3) of the Act immediate measures must be taken to prevent any risk of spreading or incorporation **when these limits are exceeded** and whenever skin contamination is found.

The β/γ Contamination Monitor LB 1210 B is such an instrument, because it

- offers maximum sensitivity
- operates independently of any mains or counting gas supply and is therefore always instantly ready for use
- greatly encourages regular use because of its handiness and convenient operation.

With the β/γ Contamination Monitor LB 1210 B you can

- detect these limits even – and mainly – with radionuclides which are so difficult to measure, e.g. ^{125}I or ^{14}C (If you would like to know more about the definition and problems of detection limits, please return the enclosed reply card)
- average over 100 cm^2 (its detector surface is 100 cm^2) so that the margin which the above Act inherently allows is fully covered.

For clean working

On the other hand, there is the golden rule of all chemical laboratories, namely to work as cleanly as possible as the reliability of the results may depend on it. In the case of radioactive substances it is particularly easy to detect contaminations when the right instrument is available.

Portable Contamination Monitor LB 1210 B/LB 1210 C

1. Brief Description

The monitor LB 1210 is a battery-operated portable rate-meter with a large-area proportional counter tube having a 100 cm^2 effective window area integrated into the base plate. The count rate is indicated in $[s^{-1}]$ (cps) in two or three quasi-logarithmic ranges 30/300/3000.

2. Applications

The Monitors LB 1210 B and LB 1210 C can be used as follows:

- Hand-held unit for detecting contaminations on worktops objects, clothing etc.
  Operating mode: with short time constant and audible single-pulse indication.

- Instrument for measuring contamination levels in $\mu Ci/cm^2$, controling compliance with permissible limits, etc.
  Operating mode: with long time constant. The scale reading in cpm is converted into $\mu Ci/cm^2$ with the aid of the table on the base plate of the unit.

- Stationary laboratory monitor to check operating conditions. To save the batteries, the instrument can be used with an external power supply unit (optional). For these applications the unit is placed vertically so that the hands and tools can be checked during the work without having to handle the instrument.

- Floor monitor when used in conjunction with a trolley (optional).

- Electronic processing unit for connecting external detectors, e.g. in conjunction with detector probe BZ 200 XK-P and the optional trolley to form a floor monitor with increased detector area.

3. Types available

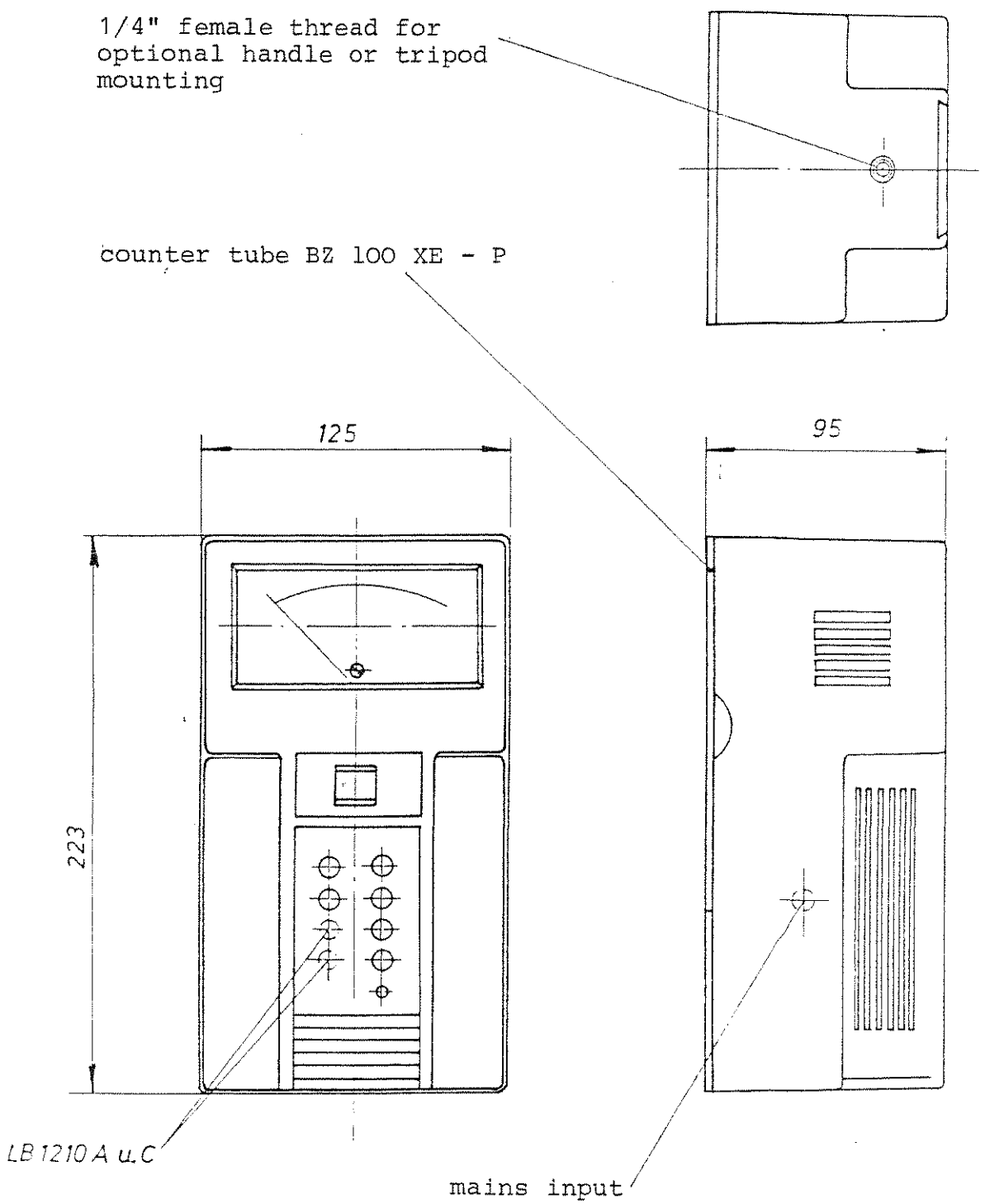
Type LB 1210 B with built-in xenon counter tube is for beta and gamma measurements, and type LB 1210 C with built-in liquid-gas filling counter tube for alpha and alpha + beta measurements. Type LB 1210 A is a modified version of type LB 1210 C which differs only in that it offers a lower available EHT and has been designed to be used with flow detectors with argon/methane (P 10 gas) as counting gas.

Type	Measures	Built-in Detector	Suitable for External Detectors
LB 1210 B (orange housing)	$\beta + \gamma$	BZ 100 XE-P xenon-filled	BZ 200 XK-P xenon-filled
LB 1210 C (yellow housing)	α and $\alpha + \beta$	MZ 100 for liquid-gas operation	MZ 200 for methane operation
LB 1210 A (yellow housing)	$\beta + \gamma$ (portable) α and $\alpha + \beta$ (stationary)	BZ 100 XE-P xenon-filled	MZ 200 for argon/methane operation

4. Nameplate

The nameplate is located below the counter tube.

3. Abmessungen und Gewicht



weight including battery: 1450 g

6. Controls and Displays

1 Optical indication for measuring range factor " x 10" or" x 0.1"resp.

2 Optical indication for exhaustion of batteries

3 Measuring range factor " x 10"

4 Measuring range factor " x 1"

5 Measuring range factor " x 0.1"
(applicable to LB 1210 C and LB 1210 A only)

6 High voltage for α measurements
(applicable to LB 1210 C and 1210 A only)

7 Sliding perspex cover for operating elements

8 Indication range for battery control

9 On/off push button

10 Time constant τ factor " x 10"

11 Single pulse acoustic "on/off"

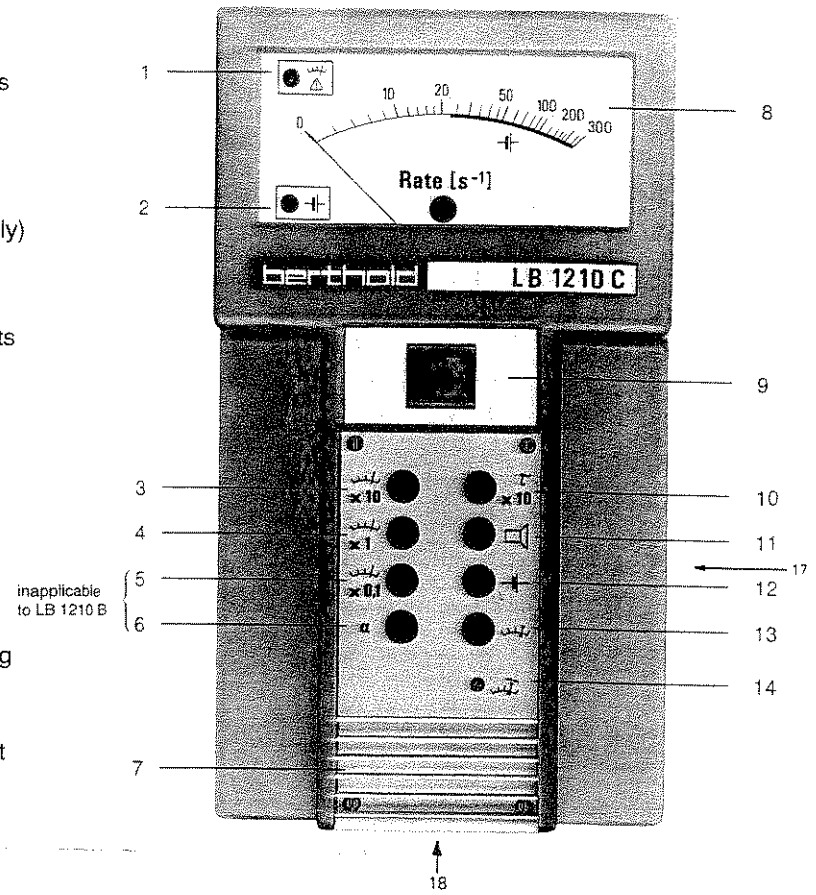
12 Battery control push button

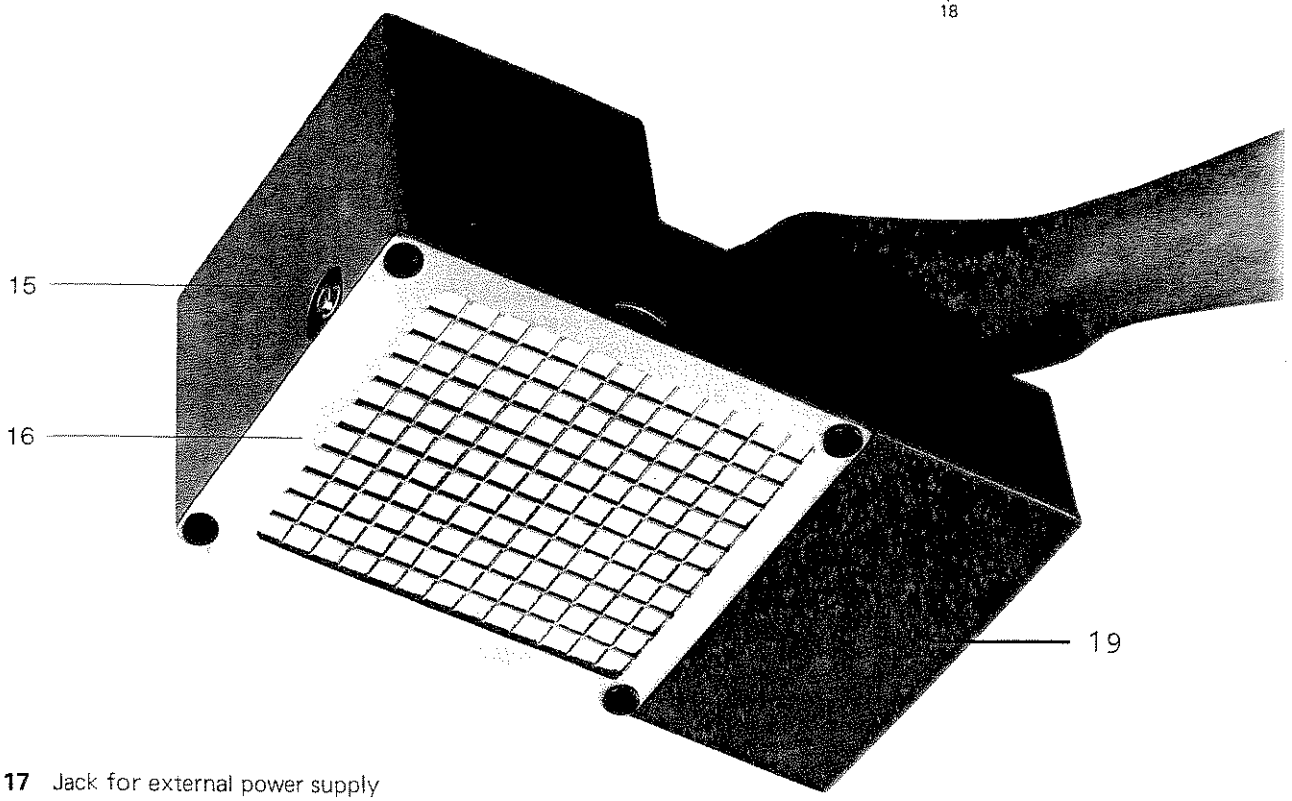
13 Threshold setting control push button

14 Slit potentiometer for threshold setting

15 Filling valve for operation with liquid counting gas (LB 1210 C only)

16 Detector probe with 100 cm^2 effective area, plugged into the bottom of the ratemeter unit





17 Jack for external power supply

18 Threaded socket for optional handle

19 Battery compartment lid

6.1 Switching on the instrument

Press the large pushbutton (9) . A signal red reflective disc appears in the pushbutton panel when the instrument is switched on.

When the instrument is first switched on, a brief random pulse sequence will be observed which, when the audible single-pulse indication is switched on, produces a rasping sound and deflects the instrument needle. Depending on the alarm threshold setting, this may cause an audible alarm. After a few seconds the indicator will have returned to its normal position and the instrument is ready to use. At normal background radiation levels it will show a background count rate of approx. 6 - 8 cps.

6.2 Battery test

The battery voltage can be checked by pressing button (12) . The needle must be within the black scale sector (8) .

The need to change the batteries is indicated automatically by a flashing LED display (2). When this LED begins to flash, operation can continue for approx. 30 min. It is recommended, however, to replace the battery immediately if possible or to continue with the external power supply unit.

When the instrument is switched off the batteries may recover so that the flashing LED display (2) will disappear when the instrument is next switched on. The LED display will, however, again begin to flash very shortly.

I m p o r t a n t : If rechargeable cells should be used instead of the dry batteries then these are not recharged whilst in the instrument.

6.3 Range selection

By pressing one of the self-locking pushbuttons (3), (4) or (5) (pushbutton 5 for LB 1210 C and LB 1210 A only) it is possible to select a range factor of 10, 1 or 0.1. LED (1) will flash to provide a clear indication when a factor other than 1 has been selected. The push-buttons are interlocked so that only one of the pushbuttons can be pressed at any given time.

6.4 Time constant (attenuates fluctuations of reading)

By pressing the self-locking pushbutton (10), the standard time constant of 2 sec. can be increased by a factor of 10 to 20 sec.

The short time constant is recommended for locating contaminations and for general measurements. The long time constant should be used for accurately checking whether previously located contaminations are within the permitted limits.

6.5 Audible single-pulse indication

Locating contaminations is made much easier by the audible single-pulse indication. The audible indication is switched on by pressing the self-locking pushbutton (11). The volume cannot be adjusted.

6.6 Alarm thresholds

The instrument provides an adjustable alarm threshold. An audible warning signal is given when the preset threshold is exceeded. The signal is limited to approx. 4 seconds. It will only be repeated if the level has dropped below the threshold since the last alarm signal. It should be borne in mind that the level at which the signal is reset is approx. 3% of the full scale length lower than the reading indicated when the threshold is exceeded (hysteris).

The audible alarm signal starts at the same scale position irrespective of the range selected. The warning tone cannot be switched off or reduced in volume.

The threshold can be adjusted with a fine screw driver by turning the slotted potentiomenter (14) as required (20 turns for full scale range). If the indicator pushbutton (13) is pressed, the position of the threshold on the scale is indicated at the same time. Pressing pushbutton (13) also starts the audible alarm so that this alarm function can be checked at the same time.

The threshold is preset at the manufacturer's works to 16 cps which, for the LB 1210 B, corresponds to the background count rate plus approx. 1 x 10^{-4} µCi/cm^2 J-125. Alternative setting see Table.

7. Checking and maintenance

7.1 Operational checks

The monitor is supplied with a plastic cover for the counter tube. A reference specimen of approx. 3 nCi Sr-90-Y-90 is attached to the inside of the cover to enable the operation of the instrument to be checked. Both cover and specimen are numbered.

When the instrument is supplied, the instrument number, counter tube number, reference sample number and the correct check reading are specified by the manufacturer.

It should be checked at regular intervals - ideally daily - whether the instrument indicates the check reading.

If this is not the case, check the following:

a) Batteries normal (section 6.2)?
   Change batteries if necessary (section 7.2).

b) Counter tube normal (section 9.1)?
Replace by new counter tube if required (section 7.3).

If the condition still persists,the instrument is faulty and must be checked by an authorized service engineer.

7.2 Battery change

To change the battery, lift the battery compartment cover (19) by twisting a coin or a screw driver blade in the slot on the front edge and raise the cover (no fixing screws).

After inserting new batteries (check for correct polarity!) the cover is replaced and pressed back into position.

The instrument is supplied complete with 6 alkaline manganese miniature dry cells, 1.5 V, Varta order no: 7244, IEC-no. LR 03. Only this type of battery will guarantee a total operating time of 72 hours. Other 1.5 V miniature cells may be used if a shorter operating time is acceptable.

The same applies to the use of rechargeable nickel-cadmium cells, e.g. type NR-AA, 12 V, 500 mAh. These cells,however, must be recharged in a separate external battery charger.

Mains operation of monitor see Sections 8.1 and 8.2.

7.3 Replacing the counter tube

The counter tube (10) is only pushed into position and can easily be replaced. It is held in position by two crimped beads at the front end and a spring-loaded ball catch on the side facing the battery compartment cover.

To remove the counter tube, place the instrument onto a work top with the base plate facing up and the battery compartment on the left. Hold the instrument with the left hand on the battery side. Place the thumb and middle finger of your right hand into the housing recess underneath the edge of the counter tube frame, support the ball of your thumb on the right-hand counter tube frame and tilt the counter tube carefully clockwise towards the top right until the ball catch is released. This movement can be assisted with the left hand if required.

Now the counter tube can be withdrawn upwards from the base tray without tilting the tube any further.

This procedure is reversed for inserting a new tube. Ensure that the EHT contact and the ground pin on the counter tube are in the correct position.

I m p o r t a n t : The ground pin position is different on each counter tube so that the xenon counter tube BZ 100 XE-P for the LB 1210 B cannot be used in the rate-meter LB 1210 C. Do not use force! This coding ensures that the xenon counter tube is not destroyed by the much higher operating voltage in the LB 1210 C.

8. Additional configurations

8.1 Operation with built-in detector and external power supply unit

For stationary monitoring of operator positions it is possible to use the instrument in conjunction with the external power supply of the LB 7616.

The power supply unit is plugged into the mains, and the jack plug at the end of the feeder cable is inserted into the socket (17) on the right-hand side of the monitor. The batteries will be disconnected automatically. When the jack plug is withdrawn, the monitor will revert to normal battery operation. All instrument circuits, including the ON/OFF pushbutton, will continue to work normally during mains operation.

8.2 Operation with external detector

The LB 1210 can also be used as an electronic rate-meter processing unit which accepts external detector signals. Two alternative configurations are possible:

a) Mobile operation with built-in batteries or external power supply unit LB 7616.

In this case the built-in counter tube is removed (see Section 7.3).and replaced by the detector adaptor. The C-socket in the adaptor accepts the connecting cable of a suitable external detector. For the LB 1210 B this will be detector type BZ 200 XK-P, for the LB 1210 C either detector type MX 200 or the tritium counter tube LB 6280 (both detectors operate with methane as counting gas).

b) Stationary operation as exit monitor in conjunction with wall mounting unit LB 1211 incorporating mains connection facilities.
The LB 1211 is a basic wall mounted unit which incorporates a power supply unit with visual "power ON" indicator and a visual alarm indicator. It is connected to a mounting which can accept detectors type BZ 200 XK-P and MZ 200.

The monitor LB 1210 is plugged into the base unit LB 1211 after the built-in detector has first been removed. This automatically provides all the necessary connections to the power supply unit and the counter tube.

This configuration can be used as an exit monitor at points of access to controlled areas.

8.3 Floor monitor operation

The LB 1210 B can be used as floor monitor in two different versions. Both versions require the optional trolley LB 1212.

When using the version with built-in detector BZ 100 XE-P, the monitor is simply placed onto the trolley so that the reading can be taken from the drawbar end of the trolley. An adaptor ensures that the instrument is securely held.

It is recommended that the audible single-pulse indication is switched on.

When checking large areas it is recommended to use the external detector 200 XK-P. In this case the trolley adaptor is removed before the detector is placed onto the trolley. A U-shaped bridge section which is lead covered to reduce the background count rate is placed over the detector. The top of the bridge section includes a suitable adaptor which accepts the monitor type LB 1210 B (from which the built-in detector has first been removed). A short length of cable is supplied for connecting the adaptor with the detector type BZ 200 XK-P.

8.4 Mounting accessories

The front face of the instrument incorporates a threaded socket (18) with a standard tripod thread (1/4", 20 turns per inch). This allows the instrument to be mounted on a camera type tripod base to monitor, for example, operator positions in laboratories.

An optional handle is also available which can be attached to the threaded socket, making it easier to carry the instrument over long distances.

9. Detector data

9.1 Detector BZ 100 XE-P (LB 1210 B)

The LB 1210 B incorporates the xenon-filled large-area proportional counter tube BZ 100 XE-P with window dimensions of 110 x 110 mm and an effective window area of 100 cm^2.

The position of the window area relative to the instrument is marked by polished strips on the outside of the instrument in the counter tube area.

The window foil is made of titanium with an area weight of 5 mg/cm^2. Calibrating data see table.

The useful plateau length ranges from 1800 to 2050 V, the operating voltage being 1900 V. The EHT supply of the LB 1210 B is preset to this voltage at the manufacturer's works. The EHT setting should only be changed by a service engineer who has access to the servicing record of the instrument. If the detector is fully intact, the window foil is taut and slightly drawn towards the inside in six parallel runs in line with the longitudinal axis of the instrument. If the foil is not taut, or it is not slightly convex, then a detector fault must be suspected.

9.2 Calibrating factors for BZ 100 XE-P (LB 1210 B)

Isotope	cps per 10^{-3} µCi/cm^2	10 cps above background level equivalent to approx.	Detection limit* approx.
^{14}C	195	5×10^{-5} µCi/cm^2	0.7×10^{-5} µCi/cm^2
^{60}Co	530	2×10^{-5} µCi/cm^2	0.3×10^{-5} µCi/cm^2
^{90}Sr-^{90}Y	3,150	0.3×10^{-5} µCi/cm^2	0.04×10^{-5} µCi/cm^2
^{125}J	130	8×10^{-5} µCi/cm^2	1×10^{-5} µCi/cm^2
^{131}J	960	1×10^{-5} µCi/cm^2	0.1×10^{-5} µCi/cm^2

*) The detection limit is a theoretical value. It is defined as that surface activity which produces the count rate equivalent to three times the statistical fluctuation (3 σ) of the background count rate. In the case of the LB 1210 B the background count rate is 8 cps. At a time constant of 20 sec., 3 σ can be calculated as $3 \cdot \sqrt{\frac{8}{2 \times 20}} = 1.34$ cps.

9.3 Effect of external radiation fields (LB 1210 B)

A radiation field*) with a doserate of 71.8 pc x kg^{-1} x s^{-1} (0.1 mR/h) produces a reading of 40 cps when the direction of incidence is perpendicular to the front face, and a reading of 70 cps when the direction of incidence is perpendicular to the window side, both figures being additional to the background count rate.

9.4 Detector MZ 100 (LB 1210 C)

The LB 1210 C incorporates a liquid-gas filled large-area proportional counter tube MZ 100 with window dimensions of 100 x 118 mm and an effective window area of 100 cm^2.

The window foil consists of metallised plastic foil with an area weight of 0.9 mg/cm^2. Calibrating data see Table.

The front end of the detector is fitted with a refill connection (15) and a relief valve which can also be closed with a knurled nut (not shown in photo on page 4).

The butane gas can be refilled from a Ronson Multifill cartridge.

9.4.1 Purging and refilling detector MZ 100

For the initial filling, or after long periods of non-use, the detector must be purged repeatedly to expel all air.

The knurled nut on the relief valve is opened by approx. one turn. The detector is purged by pressing the Ronson cartridge about 5 times for approx. 5 sec. each time against the refill connection, with approx.

*Emitter ^{226}Ra, with filtration

30 sec. between each application. During these intervals a hissing noise indicates that the air or excess gas is being discharged through the relief valve. At the same time, the convex bulge in the window foil which is produced during each refill will also largely disappear. Any residual minor convexity is not significant.

When purging is completed, wait some 2 to 3 min. to allow the pressure to equalise fully and then close the knurled nut on the relief valve.

For refilling, open the knurled nut and purge once or approx. 5 sec. as described above. Then wait a few minutes before retightening the knurled nut.

If in the course of time, for example due to extensive temperature fluctuations, the convexity of the window foil should increase then the excess pressure can be discharged from the detector by briefly opening the knurled nut.

Under normal conditions (no major pressure and temperature variations), one filling will be sufficient for 8 hours of operation. It is, however, recommended to check the instrument response occasionally with the reference source. The EHT supply of the LB 1210 C has been set at the manufacturer's works to 2.05 kV for the alpha plateau and 3.05 kV for the beta plateau.

9.5 Calibrating factors for MZ 100 (LB 1210 C)

Isotope	cps per 10^{-3} µCi/cm^2	10 cps above background level equivalent to approx.	Detection limit*) approx.
^{14}C	780	1.3×10^{-5} µCi/cm^2	0.12×10^{-5} µCi/cm^2
^{60}Co	1000	1×10^{-5} µCi/cm^2	0.09×10^{-5} µCi/cm^2
^{90}Sr-^{90}Y	2780	0.4×10^{-5} µCi/cm^2	0.04×10^{-5} µCi/cm^2
^{241}Am**)	800	1.3×10^{-5} µCi/cm^2	0.7×10^{-6} µCi/cm^2

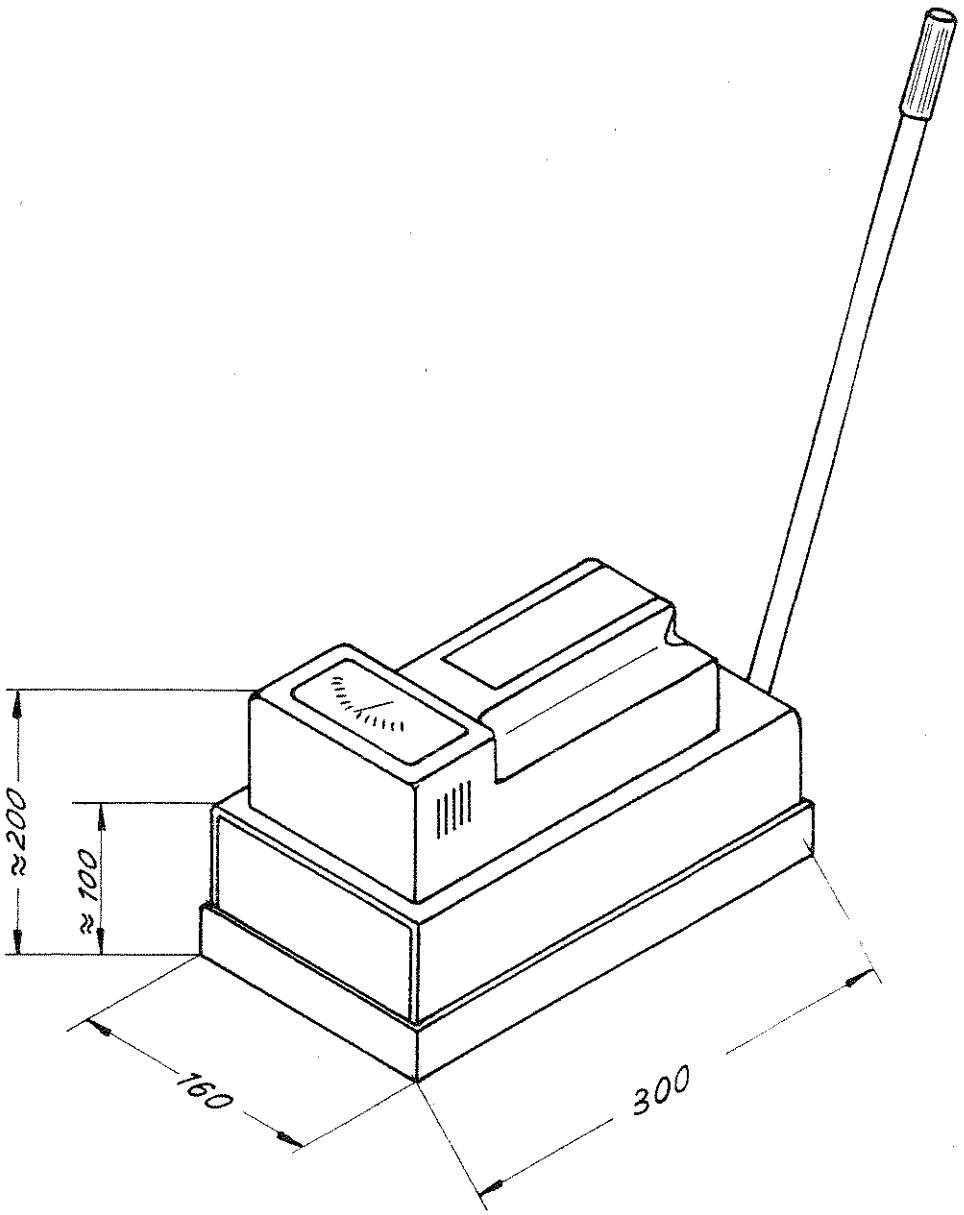
*) The detection limit is a theoretical value. It is defined as that surface activity which produces a count rate equivalent to 3 times the statistical fluctuation (3σ) of the background count rate. In the case of the LB 1210 C the background count rate in the beta plateau is 3.5 cps. With a time constant of 20 sec, 3σ can be calculated as

$$3\sqrt{\frac{3.5}{2 \times 20}} = 0.89 \text{ cps}$$

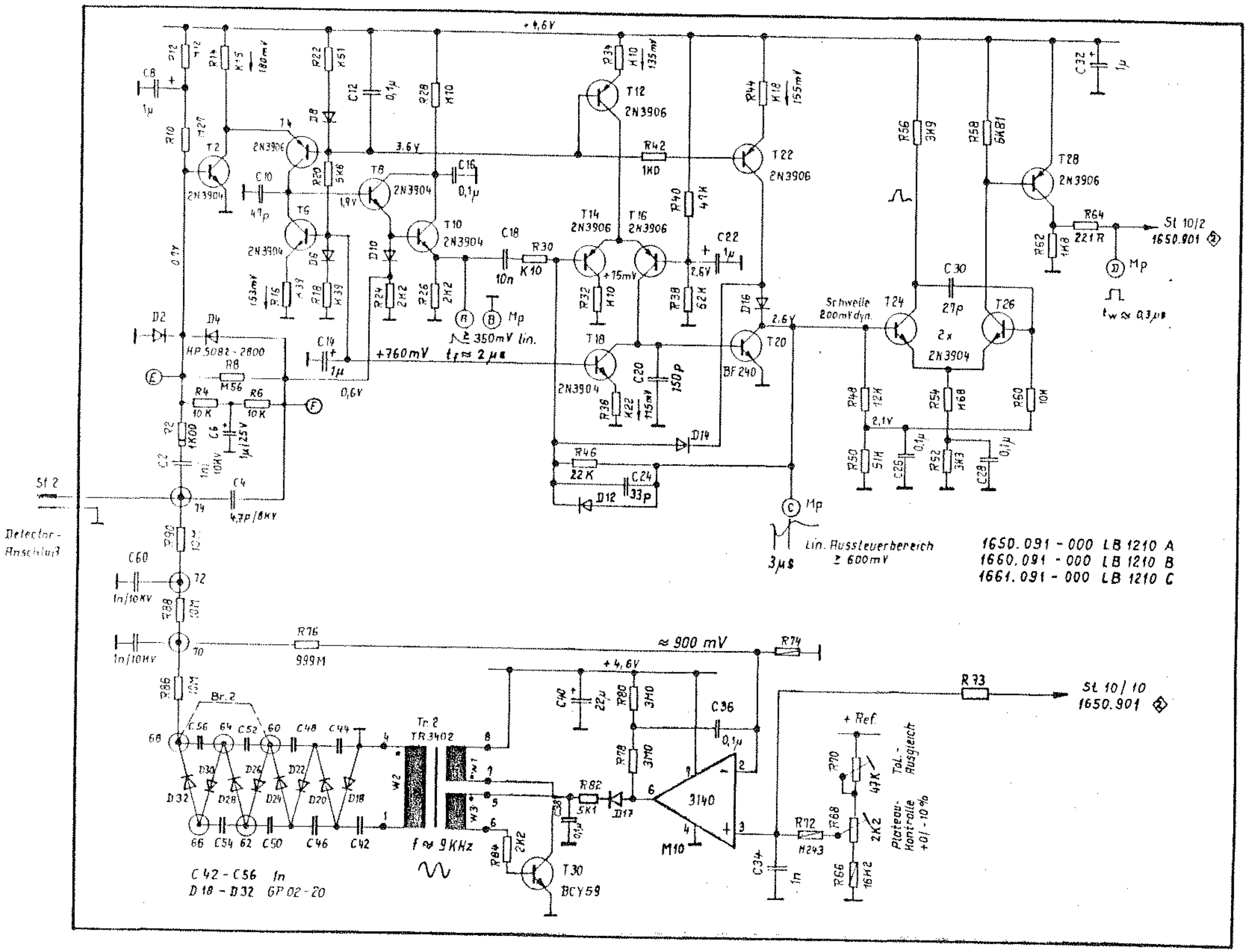
In the case of alpha measurements this calculation becomes meaningless in view of the extremely small background count rate. In this case a relatively arbitrary detection limit of 0.5 cps is assumed.

**)

Preliminary values



Werkstoff	Laboratorium PROF. DR. BERTHOLD 7547 Wildbad im Schwarzwald		Tag	Name
		gez.	4.7.78	
		gepr.		
Maßstab	Maßzeichnung: Rollwagen mit LB 1210	Zeichnung Nr.	1650.500-001	



Monitor	Hochspg.	Br. 2	D26 ÷ D32	C50 ÷ C56	R 73	R 74
LB 1210 A	1,1 / 1,9 KV	X	—	—	M 332	M 475
LB 1210 B	1,9 KV	X	—	—	—	M 475
LB 1210 C	1,85 / 3,05 KV	—	X	X	M 392	M 301

Alle nicht bezeichneten Dioden 1N914

Teflonstützpunkt

Tol. ± 1%

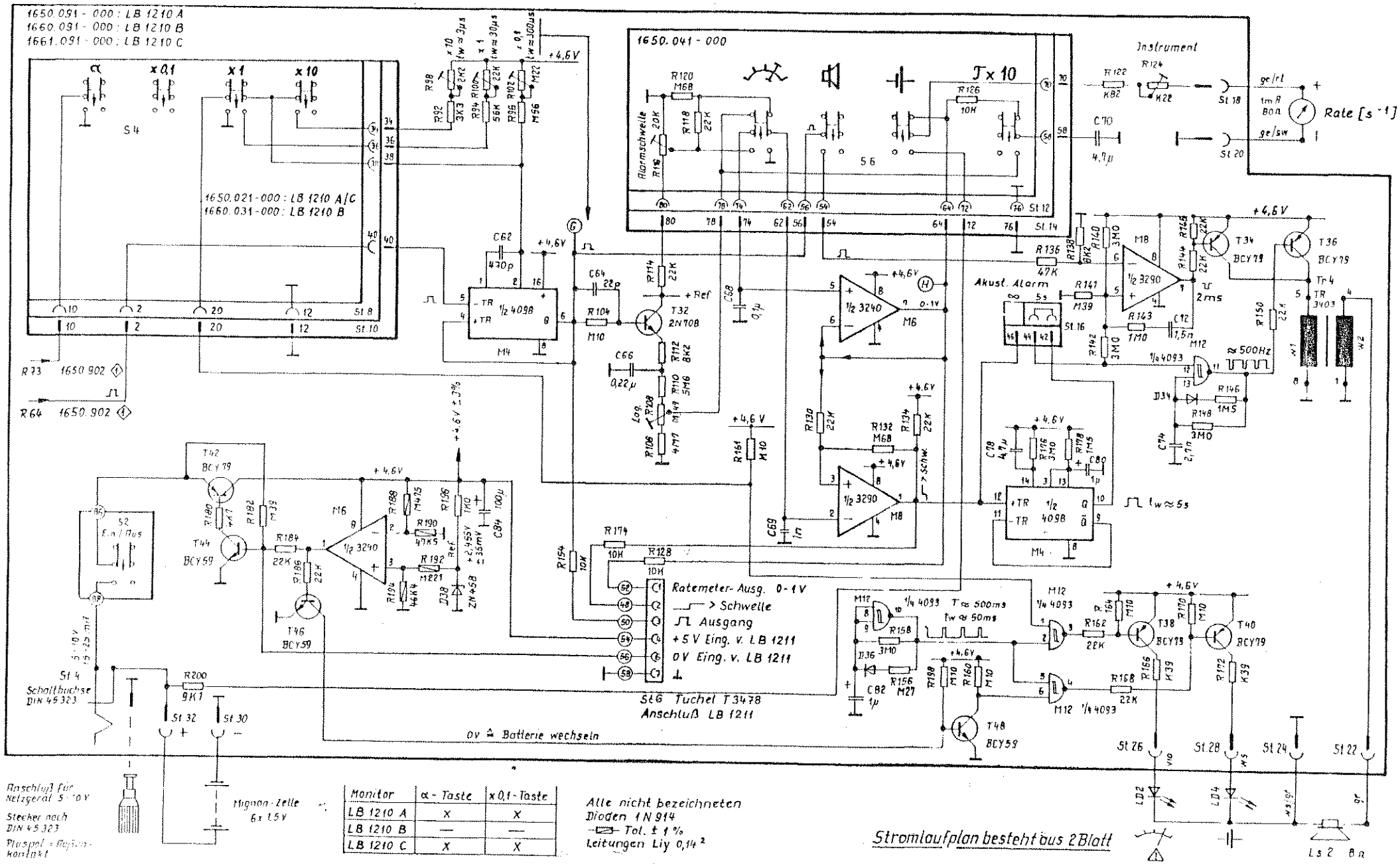
Stromlaufplan besteht aus 2 Blatt

Ausgabe	Änderung	Tag	Name
3	R73 M491 → M332, 2,05 → 1,85KV, 2,2,3,81		
2	D18 - D32 1N4007 → GP02-20	13.4.82	
1	R82 ; D17 neu	29.9.80	

	Tag	Name
gez.	2.8.79	
gepr.	23.10.79	

7547 Wildbad / Schwarzw.

Kontaminations - Monitor



Monitor	α - Taste	x 0,1 - Taste
LB 1210 A	X	X
LB 1210 B	—	—
LB 1210 C	X	X

3	Blatt 1 geändert	22.7.82	Tag	Name
2	Blatt 1 geändert	13.4.82	gez. 2.8.79	Ru
1	Blatt 1 geändert	28.9.81	gepr. 23.10.79	
Ausgabe	Änderung	Tag Name		
4	Blatt 1 geändert			