

the sensor people

VARIO B

switching light curtain for object detection



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1 General information

1.1 About this technical description

These operating instructions contain information regarding the proper and effective use of the VARIO B switching light curtain. They are included in the delivery contents.

1.2 Explanation of symbols

The symbols used in this technical description are explained below.



Attention!

Observe passages marked with this symbol. Failure to heed this information may lead to injuries to personnel or damage to the equipment.



Notice!

This symbol indicates text passages containing important information.

1.3 Declaration of Conformity

The VARIO B switching light curtain was designed and manufactured in accordance with applicable European standards and directives.

The light curtains fulfil the following standards:

- EN 60947-5-2
- Interference emissions acc. to EN 61000-6-3/4
- Interference rejection acc. to EN 61000-6-1/2
- ESD - contact discharging or air discharging on metal housing acc. to EN 61000-4-2

Leuze electronic GmbH + Co KG in D-73277 Owen/Teck, possesses a certified quality assurance system in accordance with ISO 9001.



2 Safety notices

2.1 Safety standards

The VARIO B switching light curtain was developed, manufactured and tested in accordance with the applicable safety standards. It corresponds to the state of the art.

2.2 Intended use

**Attention!**

The protection of personnel and the device cannot be guaranteed if the device is operated in a manner not corresponding to its intended use. Leuze electronic GmbH + Co. KG is not liable for damages caused by improper use. Knowledge of this manual is an element of proper use.

Light curtains of type VARIO B are designed as switching light curtains.

In particular, unauthorised uses include:

- rooms with explosive atmospheres
- operation for medical purposes

**Attention!**

The light curtains are not certified safety light barrier in accordance with EN 61496. They are not safety components in the spirit of EC machine directive 89/392/EEC with supplement 93/44/EC, appendix 4.

They must not, therefore, be used to protect persons from danger.

Areas of application

The VARIO B light curtains are designed, in particular, for the following areas of application:

- object detection in storage and materials-handling applications
- overhang controls in transport systems
- object detection and process controls in the packaging industry
- object qualification in the surface industry

2.3 Working safely

**Attention!**

Access to or changes on the device, except where expressly described in this operating manual, is not authorised.

Safety regulations

Observe the locally applicable legal normatives and the regulations of the employer's liability insurance association.

Qualified personnel

Mounting, commissioning and maintenance of the device must only be carried out by qualified personnel.

Electrical work must be carried out by a certified electrician.

3 Product description

3.1 General information

The VARIO B product line is a compact series of light curtain systems with an excellent price-to-performance ratio. The product line has been optimised for standard object detection applications. It is easy to work with and individual parameter options make it possible to meet a wide range of needs.

3.2 Performance features

Features

- Factory configuration provides plug-and-play system
- Signal output (PNP or NPN) short-circuit proof, light or dark switching
- Warning output (PNP or NPN), short-circuit proof, for conditions including soiling, malfunction and normal functionality
- Range detection mode - each output can be assigned to a detection range.
- Additional evaluation of diagonal beams
- Calibration of all beams and saving of all current brightness values
- Direct connection to 24VDC
- No separate evaluation unit or synchronisation line required
- Aluminium housing, natural anodising

Advantages for you

- Time-saving installation
- Reliable and flexible operation
- Ensures availability of the light curtain
- Increase in the information content
- Increased detection safety in sensing objects
- Individual adjustment of light curtain to different ranges
- Low installation effort
- Low installation effort
- Sturdy, very small dimensions

3.3 Function

All VARIO B light curtains are shipped with a defined parameter state. The preset functionality can be read from the type designation of the receiver:

IVBR/o-x-y-fc

- o:** type of transistor switching output
 - 4:** PNP
 - 2:** NPN
- x:** beam spacing [mm]
- y:** measurement field length [mm]
- f:** function
 - 00:** light switching, parallel
 - 01:** light switching, parallel+diagonal
 - 02:** dark switching, parallel
 - 03:** dark switching, parallel+diagonal
- c:** connection type
 - S8:** S8 connector, 4-pin
 - ,4000:** 4m cable, 4-wire

For example: **IVBR/4-12.5-188-00,4000**

The products can be installed acc. to Plug and Play as follows:

- Install light strips
- Perform automatic calibration cycle (see chapter 4.4)
- System is now ready.

The light strips are synchronised via an optical synchronisation beam (state on delivery: beam 1 - on cable edge).

The state on delivery is defined by

- **signal output**
 - 1 x switching output over entire measurement field length (black wire, pin 4)
 - 1 x warning output (yellow wire, pin 2)
- **switching function**
 - 00, 01:** light switching,
 - 02, 03:** dark switching (inverted to light switching)
- **analysis function**
 - 00, 02:** parallel beam method (only opposing receiver diodes are analysed).
 - 01, 03:** parallel/diagonal beam method (opposing as well as the next higher receiver diodes are analysed).

The VARIO B can be reconfigured for special applications.

3.4 Configuration interface

The configuration can be read out and changed using the **VARIOSoft 3.1** configuration software. The software can be downloaded as compressed ZIP file VARIOSoft 31.zip from the "detect >>" heading in the download area of the Leuze Internet site www.leuze.com under "Measuring and switching light curtains".



Figure 3.1: VB-Int-232 interface module

Connection:

- Connect the **VB-Int-232** interface module (Part No. 501 07711) according to the label to a +24VDC power supply unit,
- Connect the RS 232 connection cable to the PC,
- Connect the receiver bar (type **IVBR**) to the interface module according to the label.
- Start up **VARIOSoft 3.1** and define the COM interface.
- Switch on voltage supply.
The charge process is indicated in the lower right part of the configuration window.

3.5 Configuration software

The **VARIOsoft 3.1** configuration software can be used to change the functionality of the VARIO B light curtain. The software functions under the Windows® 95/98/2000/NT/XP operating systems.

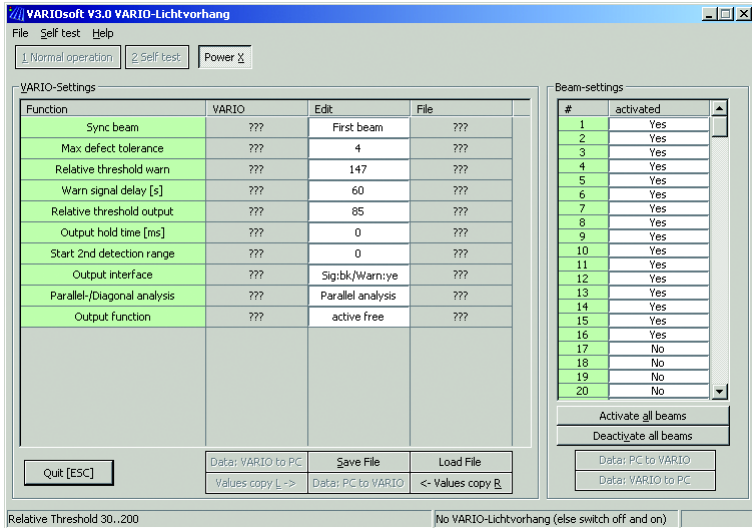


Figure 3.2: VARIOsoft 3.1 configuration window:

Configurations can be stored on the hard disk using the **File: Save** button. Saved configurations can be imported using the **File -> Configuration** menu item or the **File: Load** button. The connected receiver bar can be activated and deactivated using the **Power X** button. In general, parameters are changed in the white fields. Changed values are indicated by italic text with a yellow field background.



Attention!

After entering numeric values, you must confirm the entry with **<Return>**.

After completing changes to the parameters, this configuration is transferred to the light curtain system by clicking the **Data: PC to VARIO** button.



Attention!

Please note that only the data of the column above the button are transferred. These settings are retained even after the system is switched off.

Use the **1 Normal operation** button to switch the light curtain to the normal detection state.

3.6 Parameters

Synchronisation beam

Specifies the position of the optical synchronisation beam.



Attention!

If the synchronisation beam is interrupted, both switching outputs are activated automatically!

Input option: first beam
 last beam
 Default: first beam (connector/cable end)



Attention!

If the synchronisation setting is changed, this parameter must also be changed on the transmitter bar! To do this, connect the black pin (pin 4 on the connector) to terminal KL6 of the VB-Int-232 interface module; the configuration routine is performed in a manner analogous to that for the receiver bar.

Max defect tolerance

Definition of the maximum tolerable noisy or defective receive signals before the system switches to fault mode (flashing LEDs).



Attention!

A signal is also marked as defective if it is interrupted for longer than the set "warning time"!

Input option: 0 to 255
 Default: 4

Relative threshold warn

Definition of the signal threshold as a %; if, while in the "non-interruption state", the value falls below the value set here, soiling is indicated. The setting is made numerically in the range from 0 ... 255, whereby value '255' corresponds to 100% of the calibration threshold.

Input option: 0 to 255 (0 ... 100%)
 Default: 147 (58%)

Warn signal delay [s]

Definition of the response time in s for the warning function.

Input option: 0 to 255
 Default: 60

Relative threshold output

Definition of the signal threshold as a %; if the value falls below the value set here, a switching signal is displayed. The setting is made numerically in the range from 0 ... 255, whereby value '255' corresponds to 100% of the calibration threshold.

Input option: 0 to 255 (0 ... 100%)

Default: 85 (33%)

Output hold time [ms]

Artificial extension of the output signal in ms.

Input option: 0 to 255

Default: 0

Start 2nd detection range

Definition of a second switching range beginning with beam x.

0: Complete measurement field length is detection range, warning function is 2nd output.

>2: Warning output becomes switching output for 2nd range.



Attention!

If the synchronisation beam is interrupted, both switching outputs are activated automatically!

Input option: 0 to 255 (only max. present beams)

Default: 0

Output interface

Assignment of the signal outputs to physical pins.



Attention!

If the 2-range mode is selected, "Warning" is to be replaced with "Switch2"!

Input option: Sig bl / Warn ye
 Sig ye / Warn bl
 Sig bl / Warn: off
 Sig ye / inv Sig: bl

Default: Sig bl / Warn ye

Parallel/diagonal analysis

Definition of the analysis method.

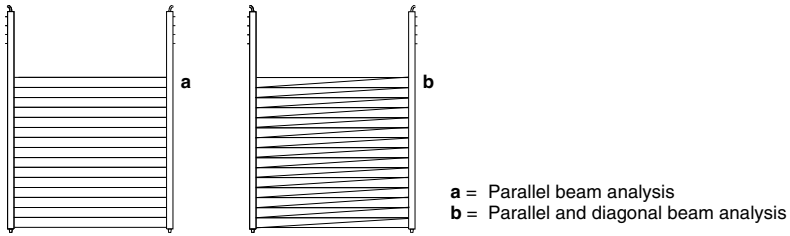


Figure 3.3: Analysis method



Attention!

If the parallel and diagonal beam method is selected, the system cycle time is doubled!

Input option: parallel analysis
P_plus_D-analysis
Default: corresponding to delivery option

Switching output function

Definition of the signal function:

Light switching: Signal active if measurement field is not uninterrupted.

Dark switching: Signal active if measurement field is interrupted (at least 1 beam).

Switching behaviour corresponding to the PNP or NPN signal definitions.



Attention!

*Mode **Dark switching** corresponds to the inverse of the light switching signal!*

Input option: light switching
dark switching
Default: corresponding to delivery option

Beam settings

Definition of the beams to be ignored (blanking). Beams which are not present are not taken into account.



Attention!

The synchronisation beam cannot be deactivated!

Input option: yes (activated)
no (deactivated)
Default: yes



Notice!

Data transfer to the light strip is performed using the

Data: PC to VARIO button located in the lower part of the window!

4 Mounting and commissioning

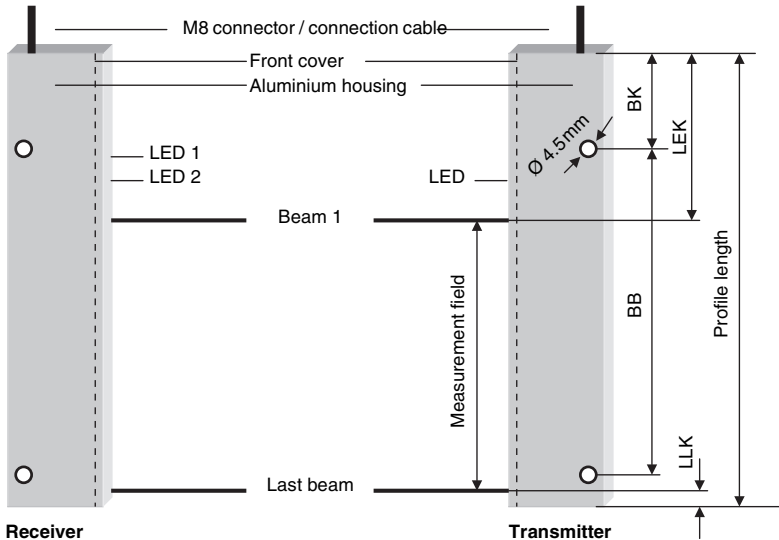


Figure 4.1: Mounting the VARIO B light curtain



Notice!

For the locations of the first and last beams to the profile edge, please refer to table 6.2 "VARIO B dimensions" on page 21.

1. The transmitter and receiver bars must be aligned with each other with an accuracy of about 10° .
2. Do not place any mechanical load on the bars or bend them, etc.
3. Be careful during horizontal mounting, as liquids may be detected on the front cover as if they were objects. If they remain there for a long time, they may penetrate the bar and damage the electronics. Increased risk of soiling.
4. Protect the cable from being crushed and from exposure to strong electromagnetic effects.
5. Strong extraneous light effect (caused for example by strobe lights, direct sunshine) on the receiver bar should be avoided.
6. Prevent optical sensors (for example other light curtains, photoelectric sensors) from affecting each other by positioning them appropriately or blocking them from each other, etc.
7. There must be no reflecting surfaces near the light curtain. Otherwise objects may not be detected due to the reflection.

4.1 Electrical connection

1. Bars must only be connected while there is no voltage in the system.
2. Avoid ground loops; all bars must have the same grounding potential.
3. A potential difference of 60V between the bar housing and the supply voltage must not be exceeded.
4. Insulate unused wires.

4.1.1 M8 plug version



Figure 4.2: Pin assignment of the M8 connector of the VARIO B light curtain

4.1.2 Cable version

Round cable, length 4 m, Ø 4.9 mm

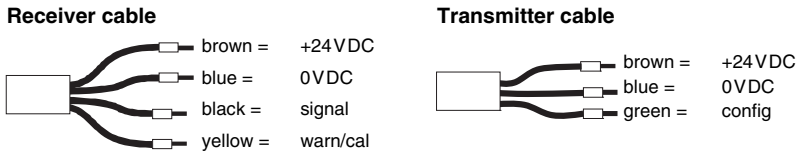


Figure 4.3: Pin assignments of the cable of the VARIO B light curtain

4.2 LED displays at the receiver

Display of the LEDs during the calibration sequence			
LED1	LED2	Operating state	Action
Illuminated	Flashes 1x	Calibration complete	Normal operation
Flashing		Defective beams	System monitoring and repair if needed
	Flashing	Defective beams	System monitoring and repair if needed
Flashing	Flashes at the same rate	Excessive value differences of the individual beams or beams have not yet been calibrated	Check the alignment of the light curtain strips
Flashing	Flashes alternately	Self-test detects system error	System monitoring and repair if needed

Table 4.1: Flashing codes of the receiver LEDs during the calibration sequence

If the reception of the respective beams is inadequate for a period of approx. 60 seconds, the light curtain indicates this state by activating the warning output. Please also observe chapter 5.

Display of LEDs during normal operation			
LED1	LED2	Operating state	Event
Off	Off	No function	Unknown
On	On	In operation	Monitoring area free
On	Off	In operation	Object detected
Flashing	On	Soiled front cover, defective beam	Monitoring area free
Flashing	Off	Soiled front cover, defective beam	Object detected
Flashing	Flashing together or alternating	Light curtain not working, defective	Unknown

Table 4.2: Display of receiver LEDs during normal operation

4.3 LED displays at the transmitter

Display of the LED		
LED	Operating state	Event
Off	No operating voltage	Check whether the transmitter is correctly connected.
On	Ready	Normal operation.
Flashing	General error mode	Wrong setting for "Last beam" or "Sync beam" or transmitter switched off via "self-test function".

Table 4.3: Display of the transmitter LEDs

4.4 Commissioning and calibrating

Please note the following procedure:

1. Mounting with alignment of the light curtain
2. Connection of the light curtain cable to the terminals provided for that purpose
3. Connect the yellow wire of the cable to the bridge to the +24VDC terminal
4. Keep the monitoring area free, especially beam 1
5. Turn on the 24VDC supply voltage
6. Disconnect the bridge between the yellow wire and +24VDC as long as the light curtain is still connected to the supply voltage
=> The upper LED (LED1) at the receiver flashes once indicating that data are being saved
7. Check the functionality of the light curtain in the entire monitoring area using an opaque object.

The calibration (items 3 to 6, yellow wire) is important for adapting the light curtain to the specific application. You should, therefore, perform the calibration for availability following a change to the application.



Notice!

Note that the monitoring area, especially beam 1 (the first beam starting from the side of the connection cable) is free.

4.5 Self-test function

The PNP input (pin 4 or green strand) can be used to switch the transmitter bar off and on. With this function, it is possible to explicitly test the system for proper function.

Activation of this function via VARIOSoft

High active (de-)activation signal (+24V)

Relative threshold output: "3"

Relative threshold warn: "0"

all beams switched off
transmitter LED flashes, LED1: 1, LED2: active
switching output: active

Low active (de-)activation signal (0V)

Relative threshold output: "0"

Relative threshold warn: "3"

all beams switched off
transmitter LED flashes, LED1: 1, LED2: active
switching output: active

5 Maintenance

The VARIO B does not require regular maintenance.

If the front cover should become soiled, clean it with a moist cloth.

- Do not use any cleaners which contain solvents to clean.
- Do not use any high-pressure cleaners or steam jet cleaners.
- When cleaning, take care not to scratch the front cover.
- If necessary, realign and recalibrate the light curtain.

6 Specifications

Optical data

Operating range	0.7 ... 5 m
Maximum number of beams	64 (as special variant: up to 96)
Light source	LED (modulated light)
Wavelength	880nm
Permissible angular deviation	$\pm 10^\circ$ (between the transmitter bar and receiver bar)

Timing

Cycle time	parallel beam analysis: 1 ms per beam but min. 30 ms parallel/diagonal beam analysis: 2 ms per beam but min. 60 ms
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Electrical data

Operating voltage U_B ¹⁾	24V DC (+20%; -15%)
Power consumption	Approx. 8W
Outputs ²⁾	semiconductor output /4: PNP /2: NPN
Output current	max. 200 mA

Indicators

Control LEDs	2 x status LEDs in receiver bar, 1 x status LED in transmitter bar
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Mechanical data

Light curtain housing	aluminium, natural anodising, front cover made of plastic, dark red. (do not use any cleaning agents containing solvents!)
Profile cross section	12 x 58mm with 5mm beam spacing, 10 x 27mm with other beam spacings
Connection	receiver: 4-pin, transmitter 3-pin ,4000: cable variants, round cables with PVC sheathing \varnothing 4.9mm, length 4m, with ferruled ends, core cross section 0.37mm^2 -S8: M8 connector, 4-pin

Environmental data

Operating temperature	-10°C ... 45°C
Humidity	up to 90 % relative, non-condensing
Interference rejection – ambient light	operation with no interference with the effect caused by a halogen light source, 500W, outside the $\pm 15^\circ$ angular range of the beam axis, distance of 1m. operation with no interference with sunshine up to 200,000LUX outside the $\pm 25^\circ$ angular range of the beam axis.
Protection class	IP54
Standards applied	EN 60947-5-2, EN 61000-6-3/4, EN 61000-6-1/2, EN 61000-4-2

Options

Automatic calibration

- 1) 2=polarity reversal protection, use a grounded voltage supply!
- 2) 2=polarity reversal protection, 3=short-circuit protection for all transistor outputs

6.1 Order information

The products of the VARIO B series are characterised by a broad range of models.

Type code VARIO B - transmitter

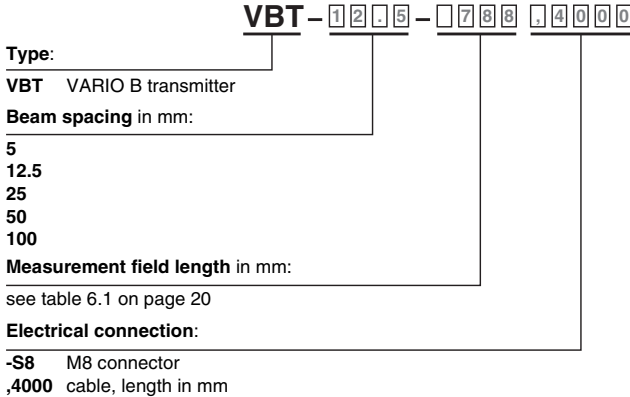


Figure 6.1: Type code VARIO B - transmitter

Type code VARIO B - receiver

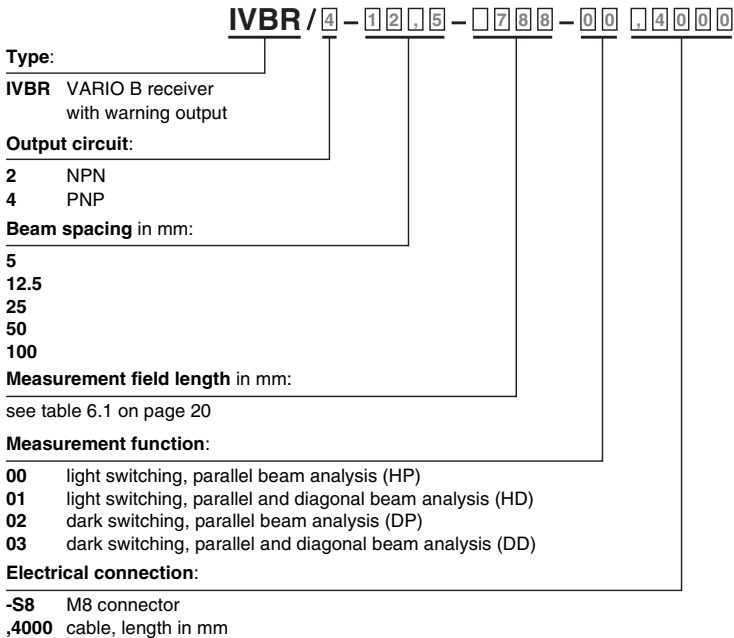


Figure 6.2: Type code VARIO B - receiver

The following parameters define a product group:

- **Family**
VBT transmitter light strip
IVBR receiver light strip
- **Beam spacing of the light axes**
5mm
12.5mm
25mm
50mm
100mm
- **Measurement function**
00 - light switching, parallel beam analysis
01 - light switching, parallel and diagonal beam analysis
02 - dark switching, parallel beam analysis
03 - dark switching, parallel and diagonal beam analysis
- **Electrical connection**
M8 connector
cable, length 4 m
- **Output circuit**
PNP switching outputs
NPN switching outputs
- **Measurement field length**
see table 6.1 on page 20

Measurement field length

		Measurement field length [mm]										
Beam spacing [mm]	5	35	75	115	155	195	235	275	315			
	12.5	88	188	288	388	488	588	688	788			
	25	175	375	575	775	975	1175	1375	1575	1775 ¹⁾	2175 ¹⁾	2375 ¹⁾
	50	350	750	1150	1550	1950	2350	2750	3150			
	100	700	1100	1500	1900	2300	2700	3100				

1) only with PNP switching output and with measurement function 00 and 02

Table 6.1: Measurement field lengths dependent on beam spacing

6.2 Dimensions

All VARIO B light curtains with a given combination of beam spacing and measurement field length have the same housing profile.

Part master	Beam spacing	Measurement field length	Number of beams	Length of profile	BK	BB	GB	GT	LLK	LEK
VB-5-35	5	35	8	120	6	108	12	58	17.5	67.5
VB-5-75	5	75	16	160	6	148	12	58	17.5	67.5
VB-5-115	5	115	24	200	6	188	12	58	17.5	67.5
VB-5-155	5	155	32	240	6	228	12	58	17.5	67.5
VB-5-195	5	195	40	280	6	268	12	58	17.5	67.5
VB-5-235	5	235	48	320	6	308	12	58	17.5	67.5
VB-5-275	5	275	56	360	6	348	12	58	17.5	67.5
VB-5-315	5	315	64	400	6	388	12	58	17.5	67.5
VB-12.5-88	12.5	88	8	260	30	200	10	27	13.5	158.5
VB-12.5-188	12.5	188	16	360	30	300	10	27	13.5	158.5
VB-12.5-288	12.5	288	24	460	80	400	10	27	13.5	158.5
VB-12.5-388	12.5	388	32	560	80	500	10	27	13.5	158.5
VB-12.5-488	12.5	488	40	660	80	600	10	27	13.5	158.5
VB-12.5-588	12.5	588	48	760	30	700	10	27	13.5	158.5
VB-12.5-688	12.5	688	56	860	80	800	10	27	13.5	158.5
VB-12.5-788	12.5	788	64	960	80	900	10	27	13.5	158.5
VB-25-175	25	175	8	360	30	300	10	27	20	165
VB-25-375	25	375	16	560	80	400	10	27	20	165
VB-25-575	25	575	24	760	30	700	10	27	20	165
VB-25-775	25	775	32	960	80	400	10	27	20	165
VB-25-975	25	975	40	1160	80	500	10	27	20	165
VB-25-1175	25	1175	48	1360	80	600	10	27	20	165
VB-25-1375	25	1375	56	1560	30	500	10	27	20	165
VB-25-1575	25	1575	64	1760	130	500	10	27	20	165
VB-25-1775	25	1775	72	1960	80	600	10	27	20	165
VB-25-2175	25	2175	88	2360	140	520	10	27	20	165

BK = bore hole to end of housing (connection) LLK = distance housing edge - last beam
 BB = bore hole to bore hole LEK = distance housing edge - first beam (connection)
 GB = housing width Profile length = LEK + measurement field length + LLK
 GT = housing depth **All dimensions in mm**

Tolerance of the beam positions: ± 2mm

Table 6.2: VARIO B dimensions

Part master	Beam spacing	Measurement field length	Number of beams	Length of profile	BK	BB	GB	GT	LLK	LEK
VB-25-2375	25	2375	96	2560	80	600	10	27	20	165
VB-50-350	50	350	8	560	80	400	10	27	20	190
VB-50-750	50	750	16	960	80	400	10	27	20	190
VB-50-1150	50	1150	24	1360	80	600	10	27	20	190
VB-50-1550	50	1550	32	1760	130	500	10	27	20	190
VB-50-1950	50	1950	40	2160	80	500	10	27	20	190
VB-50-2350	50	2350	48	2560	80	600	10	27	20	190
VB-50-2750	50	2750	56	2960	80	700	10	27	20	190
VB-50-3150	50	3150	64	3360	80	800	10	27	20	190
VB-100-700	100	700	8	970	85	400	10	27	20	250
VB-100-1100	100	1100	12	1370	85	600	10	27	20	250
VB-100-1500	100	1500	16	1770	135	500	10	27	20	250
VB-100-1900	100	1900	20	2170	85	500	10	27	20	250
VB-100-2300	100	2300	24	2570	85	600	10	27	20	250
VB-100-2700	100	2700	28	2970	85	700	10	27	20	250
VB-100-3100	100	3100	32	3370	85	800	10	27	20	250

BK = bore hole to end of housing (connection) LLK = distance housing edge - last beam
 BB = bore hole to bore hole LEK = distance housing edge - first beam (connection)
 GB = housing width Profile length = LEK + measurement field length + LLK
 GT = housing depth **All dimensions in mm**

Tolerance of the beam positions: ± 2 mm

Table 6.2: VARIO B dimensions

6.3 Accessories

The following items are available as accessories:

- M8 cable in various lengths (e.g. K-D M8A 4P-5m-PVC, Part No. 501 04526)
- Interface module VB-INT-232 (Part No. 501 07711) for PC configuration
- VARIOsoft 3.1 configuration software
(software can be downloaded as compressed ZIP file VARIOsoft 31.zip from the "detect >>>" heading in the Download area of the Leuze Internet site www.leuze.com under "Measuring and switching light curtains".)