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:
  • Interference emissions acc. to EN 61000-6-3/4 and EN 60947-5-2
  • Interference rejection acc. to EN 61000-6-1/2 and EN 60947-5-2
  • 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/EWG with supplement 93/44/EMW, 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

<table>
<thead>
<tr>
<th>Features</th>
<th>Advantages for you</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Factory configuration provides plug-and-play system</td>
<td>- Time-saving installation</td>
</tr>
<tr>
<td>- Signal output (PNP or NPN) short-circuit proof, light or dark switching</td>
<td>- Reliable and flexible operation</td>
</tr>
<tr>
<td>- Warning output (PNP or NPN), short-circuit proof, for conditions including soiling, malfunction and normal functionality</td>
<td>- Ensures availability of the light curtain</td>
</tr>
<tr>
<td>- Range detection mode - each output can be assigned to a detection range.</td>
<td>- Increase in the information content</td>
</tr>
<tr>
<td>- Additional evaluation of diagonal beams</td>
<td>- Increased detection safety in sensing objects</td>
</tr>
<tr>
<td>- Calibration of all beams and saving of all current brightness values</td>
<td>- Individual adjustment of light curtain to different ranges</td>
</tr>
<tr>
<td>- Direct connection to 24 VDC</td>
<td>- Low installation effort</td>
</tr>
<tr>
<td>- No separate evaluation unit or synchronisation line required</td>
<td>- Low installation effort</td>
</tr>
<tr>
<td>- Aluminium housing, natural anodising</td>
<td>- Sturdy, very small dimensions</td>
</tr>
</tbody>
</table>
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 4.3)
- 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 3.0 configuration software. The software can be downloaded as compressed ZIP file VARIOSoft 30.zip from the Internet at http://www.leuze.de/downloads/los/08/variosoft.zip.

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 3.0 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 3.0 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 3.0 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 value is specified as a % with respect to the calibration threshold.

Input option:  
- 0 to 255 ( = 100%)
Default:  
- 147

**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 value is specified as a % with respect to the calibration threshold.
Input option: 0 to 255 (100%)
Default: 85

**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.

```plaintext
a = Parallel beam analysis  
b = Parallel and diagonal beam analysis
```

**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

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

<table>
<thead>
<tr>
<th>M8 receiver</th>
<th>+24VDC</th>
<th>1</th>
<th>brown</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Warn/cal</td>
<td>2</td>
<td>yellow/</td>
</tr>
<tr>
<td></td>
<td>GND</td>
<td>3</td>
<td>blue</td>
</tr>
<tr>
<td></td>
<td>Signal</td>
<td>4</td>
<td>black</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>M8 transmitter</th>
<th>+24VDC</th>
<th>1</th>
<th>brown</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NC</td>
<td>2</td>
<td>blue</td>
</tr>
<tr>
<td></td>
<td>GND</td>
<td>3</td>
<td>blue</td>
</tr>
<tr>
<td></td>
<td>Config</td>
<td>4</td>
<td>black</td>
</tr>
</tbody>
</table>

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

4.1.2 Cable version

Round line, length 4 m, Ø 4.9mm

<table>
<thead>
<tr>
<th>Receiver cable</th>
<th>brown = +24VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>blue = 0VDC</td>
</tr>
<tr>
<td></td>
<td>black = signal</td>
</tr>
<tr>
<td></td>
<td>yellow = warn/cal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transmitter cable</th>
<th>brown = +24VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>blue = 0VDC</td>
</tr>
<tr>
<td></td>
<td>black = config</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>LED1</th>
<th>LED2</th>
<th>Operating state</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illuminated</td>
<td>Flashes 1x</td>
<td>Calibration complete</td>
<td>Normal operation</td>
</tr>
<tr>
<td>Flashing</td>
<td></td>
<td>Defective beams</td>
<td>System monitoring and repair if needed</td>
</tr>
<tr>
<td>Flashing</td>
<td>Flashing</td>
<td>Defective beams</td>
<td>System monitoring and repair if needed</td>
</tr>
<tr>
<td>Flashing</td>
<td>Flashes at the same rate</td>
<td>Excessive value differences of the individual beams or beams have not yet been calibrated</td>
<td>Check the alignment of the light curtain strips</td>
</tr>
<tr>
<td>Flashing</td>
<td>Flashes alternately</td>
<td>Self-test detects system error</td>
<td>System monitoring and repair if needed</td>
</tr>
</tbody>
</table>

Table 4.1: Flashing code of the 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.

<table>
<thead>
<tr>
<th>LED1</th>
<th>LED2</th>
<th>Operating state</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>Off</td>
<td>No function</td>
<td>Unknown</td>
</tr>
<tr>
<td>On</td>
<td>On</td>
<td>In operation</td>
<td>Monitoring area free</td>
</tr>
<tr>
<td>On</td>
<td>Off</td>
<td>In operation</td>
<td>Object detected</td>
</tr>
<tr>
<td>Flashing</td>
<td>On</td>
<td>Soiled front cover, defective beam</td>
<td>Monitoring area free</td>
</tr>
<tr>
<td>Flashing</td>
<td>Off</td>
<td>Soiled front cover, defective beam</td>
<td>Object detected</td>
</tr>
<tr>
<td>Flashing</td>
<td>Flashing together or alternating</td>
<td>Light curtain not working, defective</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

Table 4.2: Display of LEDs during normal operation
4.3 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 (LED 1) 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.
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 … 5m
Maximum number of beams 64
Light source LED (modulated light)
Wavelength 880nm
Permissible angular deviation ±10° (between the transmitter bar and receiver bar)

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

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

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

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 lines with PVC sheathing Ø 4.9mm,  
length 4m, with ferruled ends  
\(^{-S8}\): M8 connector, 4-pin
Core cross section 0.34mm\(^2\)

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 ±15° angular range of the beam axis, distance of 1m.  
operation with no interference with sunshine up to 200,000LUX outside the ±25° angular range of the beam axis.
Protection class IP54  
Standards applied EN 61000-6-3/4 and EN 60947-5-2,  
EN 61000-6-1/2 and EN 60947-5-2,  
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**

<table>
<thead>
<tr>
<th>VBT</th>
<th>12.5</th>
<th>78</th>
<th>0000</th>
</tr>
</thead>
</table>

**Type:**

VBT  VARIO B transmitter

**Beam spacing in mm:**

- 5
- 12.5
- 25
- 50
- 100

**Measurement field length in mm:**

see table 6.1 on page 20

**Electrical connection:**

-S8  M8 connector

,4000  cable, length in mm

Figure 6.1:  Type code VARIO B - transmitter

**Type code VARIO B - receiver**

<table>
<thead>
<tr>
<th>IVBR</th>
<th>12.5</th>
<th>78</th>
<th>0000</th>
</tr>
</thead>
</table>

**Type:**

IVBR  VARIO B receiver

with warning output

**Output circuit:**

- 2  NPN
- 4  PNP

**Beam spacing in mm:**

- 5
- 12.5
- 25
- 50
- 100

**Measurement field length in mm:**

see table 6.1 on page 20

**Measurement function:**

- 00  light switching, parallel beam analysis (HP)
- 01  light switching, parallel and diagonal beam analysis (HD)
- 02  dark switching, parallel beam analysis (DP)
- 03  dark switching, parallel and diagonal beam analysis (DD)

**Electrical connection:**

-S8  M8 connector

,4000  cable, length in mm

Figure 6.2:  Type code VARIO B - receiver
The following parameters define a product group:

- **Family**
  - VBT transmitter light strip
  - IVBR receiver light strip

- **Output circuit**
  - PNP switching outputs
  - NPN switching outputs

- **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 4m

### Measurement field length

<table>
<thead>
<tr>
<th>Beam spacing [mm]</th>
<th>Measurement field length [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>35 75 115 155 195 235 275 315</td>
</tr>
<tr>
<td>12.5</td>
<td>88 188 288 388 488 588 688 788</td>
</tr>
<tr>
<td>25</td>
<td>175 375 575 775 975 1175 1375 1575 1775(^1) 2175(^1) 2375(^1)</td>
</tr>
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\(^1\) only with PNP switching output, available as cable version and with measurement function 00!

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.

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<tr>
<th>Part master</th>
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<th>Measurement field length</th>
<th>Number of beams</th>
<th>Length of profile</th>
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<th>BB</th>
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BK = bore hole to end of housing (connection)  
BB = bore hole to bore hole  
GB = housing width  
GT = housing depth  
LLK = distance housing edge - last beam  
LEK = distance housing edge - first beam (connection)  
Profile length = LEK + measurement field length + LLK  
All dimensions in mm  

Tolerance of the beam positions: ± 2mm  

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 3.0 via the Internet: [http://www.leuze.de/downloads/los/08/variosoft.zip](http://www.leuze.de/downloads/los/08/variosoft.zip)

---

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<th>Beam spacing</th>
<th>Measurement field length</th>
<th>Number of beams</th>
<th>Length of profile</th>
<th>BK</th>
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**Definitions:**

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

All dimensions in mm

Tolerance of the beam positions: ± 2mm

Table 6.2: VARIO B dimensions