


Operating Instructions

Optical Anti-Collision Device

Type PV1037/2

E_52582.pdf

<p>Features</p> <ul style="list-style-type: none">✓ Clearance distance of up to 50 m✓ Greatest performance in terms of detection capability✓ Pollution warning✓ Integrated test system – continuous function check of the electronics✓ Safe mounting of reflectors	<p>Applications</p> <ul style="list-style-type: none">○ Collision protection○ Maintaining distance <p>with respect to cranes that run on a common crane track or rail.</p>
	

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Table of Contents

1. Identification	3
1.1 Product versions / type plates	3
1.2 Name and address of the manufacturer	3
1.3 Definition of symbols:	3
2. Product description	3
2.1 Product mark	3
2.2 Intended use, general function and area of application	4
2.3 Incorrect use and foreseeable misuse	4
2.4 Safety information	5
3. Definitions – technical data	6
4. Operating instructions	7
4.1 Information on this technical description	7
4.2 Device description	8
4.3 Description of function	9
4.3.1 Triangulation triangle	9
4.3.2 Approach travel	9
4.3.3 Continually self-testing	10
4.3.4 Movement of the crane is possible	10
4.3.5 Movement of the crane is stopped	10
4.4 Dirt accumulation control function	10
4.5 Assembly	11
4.5.1 Horizontal arrangement of the triangulation triangle	11
4.5.2 Distance monitoring accuracy	12
4.6 Information on assembly	13
4.7 Adjustment using the “light beam method”	14
4.8 Electrical connection	15
4.9 Applicable documents	16
5. Maintenance and cleaning	16
6. Decommissioning	16
7. Spare parts	17

1. Identification



1.1 Product versions / type plates

PV1037/2
PV1037/2*01

1.2 Name and address of the manufacturer

Fotoelektrik Pauly GmbH
Wahrbrink 6
59368 Werne, Germany

1.3 Definition of symbols:

	Must follow – Critical information This symbol describes safety warning of dangerous situations and indicates necessary measures and / or appropriate precautionary measures. Failure to comply can result in death or property damage.
	Must know – Important information This symbol describes e.g. situations that could damage the product or devices in its vicinity, and accordingly provide appropriate action. The sign identifies particularly important passages.

2. Product description

2.1 Product mark

PV1037/2 and PV1037/2*01: high performance reflex light barriers for distance monitoring tasks using the triangulation method.

2.2 Intended use, general function and area of application

Acknowledgement of the contents of these operating instructions forms part of the intended use. Notes and safety information should be observed in particular.

The Model PV1037/2 System is

- a mechanism for collision protection and distance monitoring for cranes or similar machines that run on a common crane track.

When used as collision protection device, the moving crane is prevented from colliding e.g. brought to a standstill in reference to the other crane (opposite crane).

When used as a distance monitoring device, a risk triggering approach of cranes is detected.

At least one device is required for each crane and the corresponding reflector is positioned at the opposite wall/crane.

2.3 Incorrect use and foreseeable misuse

It is not permissible to use the device in any manner that deviates from the contents of the operating instructions or operate it outside the prescribed areas of application.

The Model PV1037/2 System is not suitable for operation in

- areas with significant environmental challenging requirements (e.g. potentially explosive areas).
- collision protection of e.g. Industrial trucks or similar transport equipment.
- use without reflector (please refer section 3).

Any technical alterations will result in cancellation of the product warranty!

2.4 Safety information



System-related movement tolerances of crane system components and the possible associated effects on the switching behaviour of the distance monitoring system must be taken into consideration when planning crane systems.



A correct assembly and alignment of the system are essential for the correct operation of the system's safety function.



The set clearance distance could be reduced, e.g. by fog, steam, smoke, snow or rain.

During limited vision, e.g. caused by fog, steam or snow, the function of the distance monitoring system must be checked by moving the cranes together.



The light beam on the system must not be interrupted, for example by obstructions or suspended objects. It is essential that proper attention is paid to this during assembly and operation of the system.



Before commencement of work, the system's function should be checked by moving the cranes together (daily functional check).



The installation of the light barriers may only be performed by authorized technical personnel who have the requisite professional expertise to install electrical devices on crane systems.



The device must be immediately taken out of operation in the event of damage or leaks in the housing, cable or line entries.



Requirements resulting from provisions relating to cranes must be applied under all circumstances.



Further or supplementary protective measures may be required on the basis of risk assessments for special areas of application.



The crane operator and/or the crane manufacturer must be aware and comply to the information that applies to his area of deployment; this also applies to the product, cables and lines installation



If condensation on the reflector surface cannot be excluded for an application with high air humidity or/and abrupt change in temperature then an anti-fogging coated reflector version must be used. A suitable reflector type will be model 4R100BLAF or model 18R100BLAF (see catalog of applicable documents in section 4.9).



If the device is operated in conjunction with other components such as control systems or sensors, the corresponding user instructions must be heeded.

3. Definitions – technical data

	PV1037/2	PV1037/2*01
Maximum clearance distance	50 m	25 m
Optical Systems	1	
Power supply / output or current consumption	(●: Option)	
230VAC ± 10 %	● / 10VA	
115VAC ± 10 %	● / 10VA	
24VDC + 20 % / - 10%	● / ~ 350mA	
Connection	2 x cable glands; terminal strip	
Switching outputs		
Main contact	2 x relay NO contacts; supervised & force guided	
Status message	1 x relay NC contact	
Pollution warning (when sighting reflector)	1 x relay change-over contact	
Switching capacity		
Min. switching current	10 mA @ > 5 V	
Main contact (to switch off the travel movement)	AC1: 5 A @ 230 VAC DC1: 6 A @ 24 VDC AC15: 2 A @ 230 VAC DC13: 1 A @ 24 VDC	
Status message	AC1: 5 A @ 230 VAC DC1: 6 A @ 24 VDC AC15: 1 A @ 230 VAC DC13: 1 A @ 24 VDC	
Pollution warning	AC1: 6 A @ 250 VAC DC1: 6 A @ 24 VDC AC15: 2 A @ 250 VAC DC13 ¹ : 1 A @ 24 VDC	
Electrcal life	DC1: > 1 x 10 ⁶ @ max. switching capacity AC1, AC15, DC13:> 2 x 10 ⁵ @ max. switching capacity	
Switching rate	3/s	
Access time	≤ 80 ms	
Switching displays	2 x LED green	
Level indicator (for sighting reflector)	4 x LED red (DIANA)	
Transmitted light	850 ... 880 nm, invisible	
Steady light resistance	> 80 kLux	
Operating mode	Alternating light, dynamic, continually self-testing	
Signal mode	Dark switching	
Housing	Cast aluminium	
Protection mode	IP65 – protection against dust and jets of water	
Weight	~ 2500 g (without adjustment flange)	
Operating temperature	- 25 °C ... + 60 °C, non-condensing	
Special functions		
Pollution warning	The light signal level is evaluated when sighting the reflector.	

¹ With spark suppressor only, see Section 4.8

	PV1037/2	PV1037/2*01
Accessories		
Reflectors	<i>(recommended clearance distance)</i>	
4R100BL	0,5 ... 25 m	1 ... 25 m
4R100BLAF	0,5 ... 25 m	1 ... 25 m
18R100BL	0,5 ... 50 m	1 ... 25 m
18R100BLAF	0,5 ... 50 m	1 ... 25 m
Adjustment flange	JF152S	

Re PV1037/2*01: device without optical sensing behaviour in range 1 to 6 m.

4. Operating instructions

4.1 Information on this technical description

These operating instructions contain information on the correct and effective use of the PV1037/2... distance monitoring system. They constitute a component of the scope of delivery.

4.2 Device description

A distance monitoring system or collision protection system consists of a reflex light barrier and a reflector. With the PV1037/2... single channelled distance monitoring system a specific distance is set. The distance is set using the triangulation principle.

The electronics of the reflex light barrier are incorporated in a housing that has protection class IP65. An optional protection roof protects the lens system of the reflex light barrier against external conditions, for example rain, snow or dust. The optional protection roof is fixed on the enclosure lid. For opening the lid, the protection roof can be folded up.

An adjustment flange is available for mounting the reflex light barrier. This enables fast and accurate assembly and alignment.

The internal test unit continuously generates defined light signals that impacts on the receiver unit and simulates the light reflected by the reflector. A highly dynamic signal processing procedure evaluates the rays of light pulses received. This evaluation means that the distance monitoring system is very failsafe, shock resistant, resistant to extraneous light and stable.

The reflector on the other crane comes into sight once the clearance distance set has been reached. Sighting the reflector as well as any internal component errors substantially alters the dynamic signal processing procedure, thereby causing the crane movement to stop (→ halt state).

The reflex light barrier continuously performs tests on its function using the highly dynamic signal processing procedure - "continually self-testing". Significantly weakened signals that could substantially impair the function are detected at an early stage and directly lead to the crane movement stopping (→ halt state).

The high optical performance of the system means the distance monitoring system can be used for distances up to 50 m and still have very considerable reserves in terms of function.

The integrated signal-emitting contamination evaluation is effective for the current reflector view and evaluates the current signal level. If the signal level on the active reflector view is too low the contamination is displayed via a signalling contact.

The requisite reflector plates on the reverse are available in different sizes. The format to be used for the reflector is determined by the clearance distance and the resultant triangulation angle.

For clearance distance	Reflector area (width x height)	Model
up to 25 m	400 mm x 100 mm	4R100BL, 4R100BLAF
up to 50 m	900 mm x 200 mm	18R100BL, 18R100BLAF

The reflector comprises a carrier plate with individually mounted reflector elements on it.

4.3 Description of function

4.3.1 Triangulation triangle

The clearance distance is determined using the triangulation method. For this purpose the high performance reflex light barrier must be aligned at an angle to the direction of movement of the crane towards the reflector affixed to the other crane. The right-angled triangulation triangle is formed as follows: *(when sighted from the light barrier)*

- from the distance between the two cranes – connecting line between the installation location of the light barrier and the left reflector edge = adjacent side to angle Δ and
- from the width of the reflector = opposite leg to the angle Δ and
- from the outer light cone from the reflex light barrier = hypotenuse of the right-angled triangle.

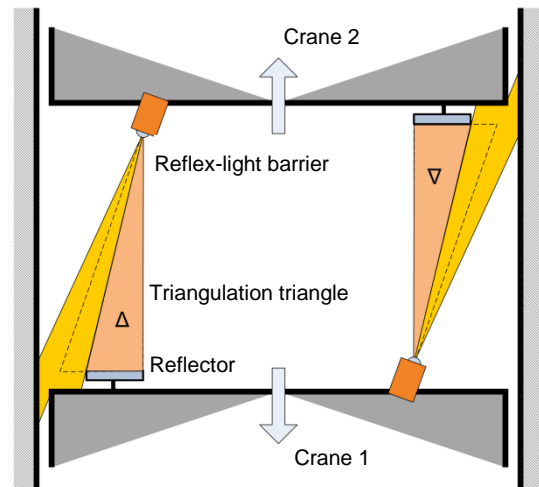


Fig.: 4.3.1

4.3.2 Approach travel

The reflex light barrier illuminates the edge of the reflector during the approach travel and when the set clearance distance is reached. The reflex light barrier sights the reflector. The switching outputs of the reflex light barriers are disconnected.

**The crane travel is brought to a halt!
The cranes are kept at a safe distance
from each other.**

The level of the light signal depends on the degree of coverage by the light spot of the reflex light barrier on the reflector. Even very small amounts of cover lead to very high signal levels. This results in a signal level with extremely steep edges.

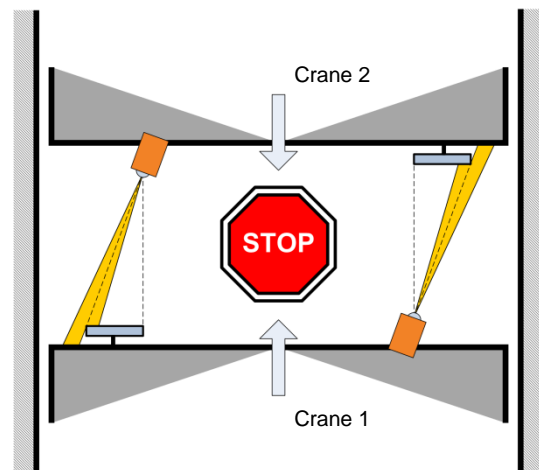


Fig.: 4.3.2

4.3.3 Continually self-testing

During the entire operation the light reflected by the reflector is reproduced by the internal test unit. The test unit generates a modulated light signal and shines onto the receiver. The modulated test signal received is evaluated by the highly dynamic signal processing procedure. In this manner a functional check of the electronic construction elements is conducted simultaneously. The light barrier performs self-tests continuously.

If the reflector is not sighted and if no electronic faults are present, the NO contacts of two separate and mutually monitored switching relays are switched on. The design has resulted in relays that are specially qualified. Positively driven contacts here ensure a high degree of reliability. The power via the contacts has to be limited by an overcurrent protection device to 6 A.

4.3.4 Movement of the crane is possible

Prerequisite: the reflector cannot be sighted. The actual distance between the cranes is greater than the set clearance distance. The beams of the reflex light barrier past the reflector. There are no electronic faults.

Effect: the crane is cleared for movement. Two relays are switched on and these signal the clearance for crane movement through the closed NO contacts. 2 green status LEDs are switched on directly with the relays and visualise the clearance for crane travel.

4.3.5 Movement of the crane is stopped

Prerequisite: the set clearance distance is reached during the approach travel. The reflector edge of the other crane moves into the beam of the reflex light barrier.

Effect: the reflex light barrier sights its emitted light signal and switches the two relays off. The green status LEDs darken. The clearance for travel is cancelled.

REMARK:

Depending on the task, the cancellation of the travel clearance can be used either to reduce the speed or to activate the brake system.

When used as intended, the system serves to halt the movement of the crane when approaching or when reaching the set clearance distance. For the abovementioned function 2 PV1037/2 systems must be installed or the PV1038/2 system must be deployed.

4.4 Dirt accumulation control function

The reflector signal level is evaluated with active reflector view. At this time the undershooting of a specific signal level leads to a dirt accumulation signal.

The respective dirt accumulation signals are displayed with the dirt accumulation relay (VK-relay). The triggered relay means: There is dirt accumulation present which should be eliminated as quickly as possible.



Notice: An appropriate warning system should be triggered by the dirt accumulation relay.

4.5 Assembly

4.5.1 Horizontal arrangement of the triangulation triangle

Reflector (①) and light barrier (②) are mounted horizontally. The triangulation triangle (③) then lies in the space horizontally. ② is mounted onto the crane using the JF152S adjustment flange. An imaginary line (④) that runs parallel to the crane track (⑤) connects ② on the right edge of the reflector (⑥). The angle (⑦) of the triangulation triangle should be selected such that the ② is pointing towards the left reflector edge when the limit distance is reached (⑧) (see also chapter on “adjustment”).

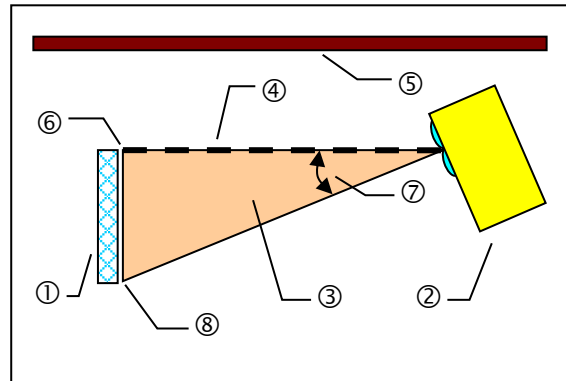


Fig.: 4.5.1-1: Example of a triangulation triangle clamped to the left

The triangulation triangles must be designed in such a way that the light barrier optics do not look into each other, directly or via reflections. Examples:

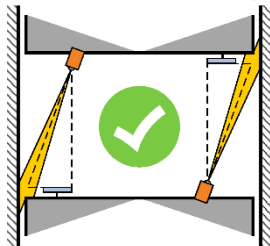


Fig.: 4.5.1-2: Proper arrangement

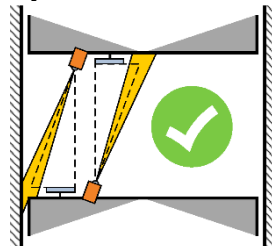


Fig.: 4.5.1-3: Proper arrangement

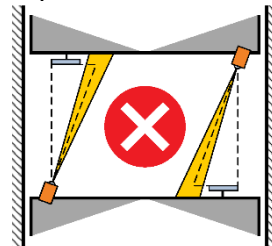


Fig.: 4.5.1-4: Wrong arrangement

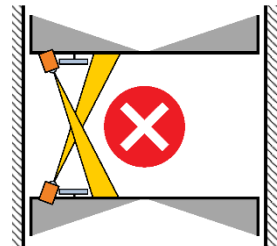


Fig.: 4.5.1-5: Wrong arrangement

Note to fig. 4.5 1-3: The distance between the applied outer edge of the device and the reflector must be at least 200mm.

The Reflector and light barrier must be mounted at the same height. This means that the middle of the reflector (①) must be positioned at the same height (⑩) as the middle of the lens system of the light barrier (②). The height of both parts should be taken from a common reference point (⑨).

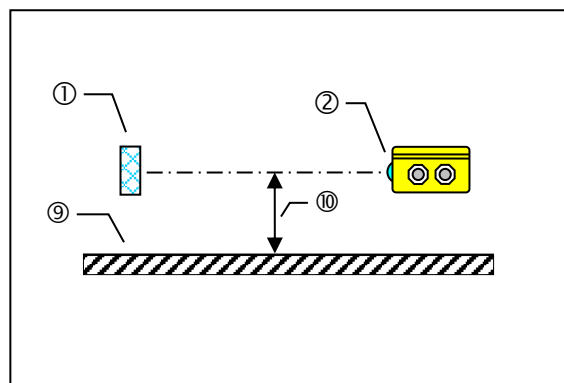


Fig.: 4.5.1-6



It is essential to ensure that the optical channel can still sight the reflector when both cranes have been moved together up to buffer distance!



Mount the reflector close to the edge of the crane bridge. Avoid blocking the visible area of the reflector.

4.5.2 Distance monitoring accuracy

The clearance distance (①) is determined by the fixed beam angle set (Δ). The accuracy and the reproducibility of the clearance distance depend on the movement tolerances of the individual crane components. Horizontal lateral shifts or rotations of the crane bridges have a direct impact on the installation position of the reflex light barrier (②) or the reflector (③) and accordingly shorten or lengthen the clearance distance set.

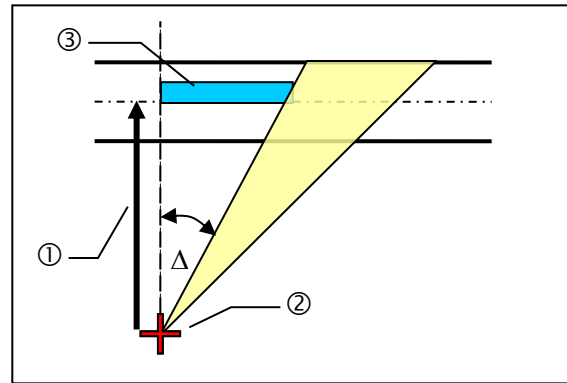


Fig.: 4.5.2-1: Set clearance distance

Lengthening the clearance distance

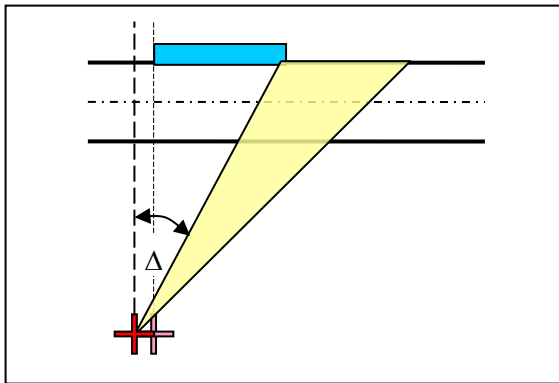


Fig.: 4.5.2-2: Shifting to the left

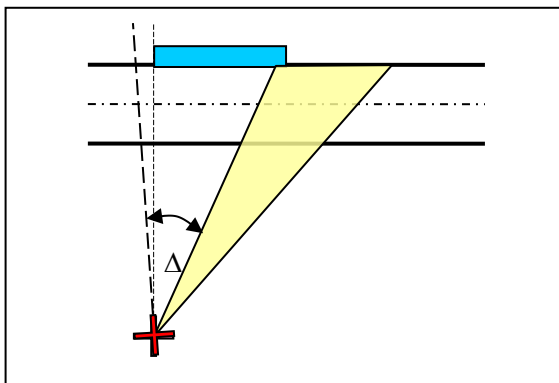


Fig.: 4.5.2-4: Rotation to the left

Shortening the clearance distance

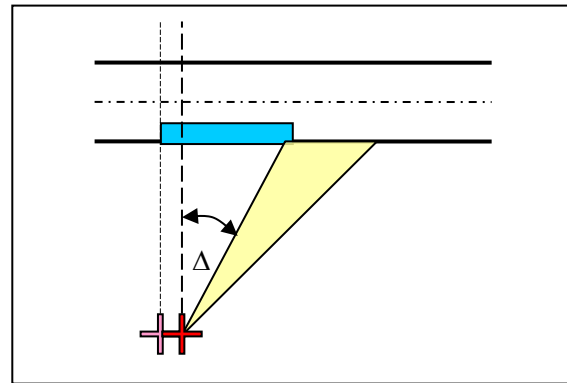


Fig.: 4.5.2-3: Shifting to the right

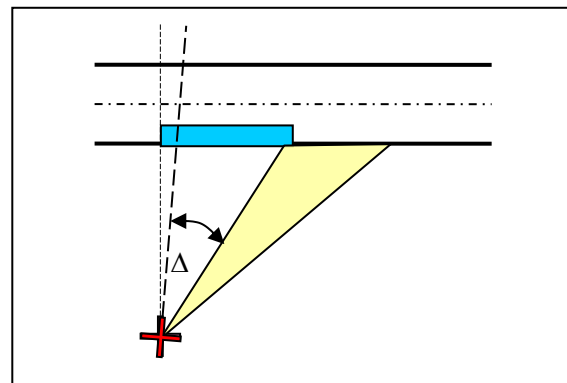


Fig.: 4.5.2-5: Rotation to the right



System-related movement tolerances in crane systems and the associated impact on the switching behaviour of the distance monitoring system should be taken into consideration at the planning stage for the crane system.

4.6 Information on assembly



The mounting has to be done in such a way that a misalignment caused by mechanical vibration or bumps can be excluded. After finishing the fine alignment, the adjustment flange has to be locked with the mounting surface. Drill a hole of 6mm diameter and 20mm length close to each fastening hole and pin the adjustment flange with the enclosed spring dowel sleeves.



The reflector must be installed in non-accessible areas or must be concealed.



The reflector should be protected from pollution by suitable measures e.g. a protective housing.



The light beams of the systems must not be interrupted e.g. obstructions or suspended objects. This must be taken into account at all events during assembly and operation of the system.



It is to be absolutely ensured that the optics of the distancing assembly still has a reflector view if both cranes have driven together to buffer separation distance!



When calculating the clearance distance the reaction time of the system must be taken into consideration as decisive parameter for the stopping path of the crane.



The set clearance distance must be tested and recorded.



The reflector centre on the other crane must be situated at the optical device (lens) level (see Fig. 4.5.1.6).



The devices on a crane and the adjacent crane must be mounted in such a way that their optical system do not look into each other (directly or via reflections), Any mutual influence must be excluded (see Fig.: 4.5.1-2...-5).



In contrast to the assembly location of the reflector, assembly of the light barrier (optoelectronics) must take place at the site where more pollution is to be expected.



The fixture of the light barrier on the associated adjustment flange must be done by means of the provided fasteners.



The fastening of the reflector should take place using rivets, adhesive or welded connectors or using the screws supplied (safety screws with locking wedge), so that dismantling can only take place by destroying the fastening element.



During and after the adjustment, it must be ensured that the plastic (safety) inserted part of the lock nut engages on the thread and the springs are pretensioned.



Assembly may only be performed by a trained professional.



Triangulation angle Δ should be set $\geq 1^\circ$.

4.7 Adjustment using the “light beam method”

Both cranes are moved together to the limit distance (①). For the adjustment the end of the reflector (③) is illuminated with a portable spotlight (②) placed close to the optical unit.

With the *lid of the device open*, it is possible to detect the reflection of the brightly illuminated reflector (⑤) on the transducer bench of the reflex light barrier (④).

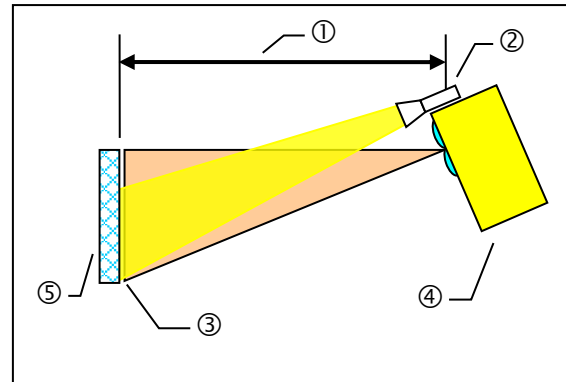


Fig.: 4.7-1

With the *lid of the device closed*, the reflector image can be observed from outside through the lens of the reflex light barrier using a special adjustment help (①).

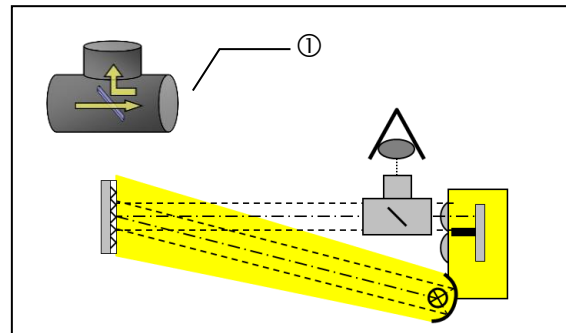


Fig.: 4.7-2

The vertical adjustment of the light barrier is set by means of the adjusting screw (①). The center of the reflector image should be adjusted to the height of the transmitter and receiver diode converter holes. The slotted mounting (②) can be used to rotate the device around the pivotal point (③) at the horizontal level.

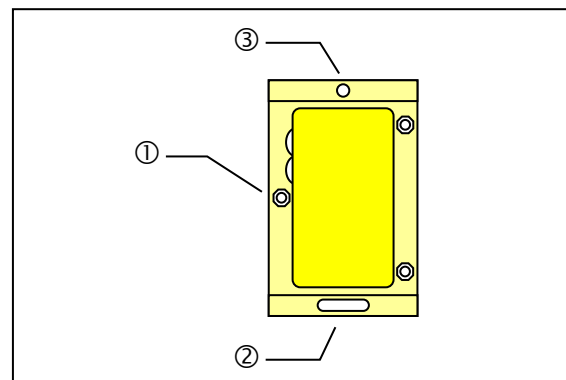


Fig.: 4.7-3

Graphical representation of the reflector image (③) on the transducer bench (①) during the adjustment procedure using the “light beam method”.

The light barrier is able to sight the reflector when the edge of the light image falls into the transmitter hole (④) or receiver hole (⑤).

If the light images of the reflector move in a straight line and horizontally across the transducer bench during the further approach travel, then the triangulation triangle is clamped absolutely horizontally. The dividing wall (②) prevents an optical short-circuit between transmitter and receiver.

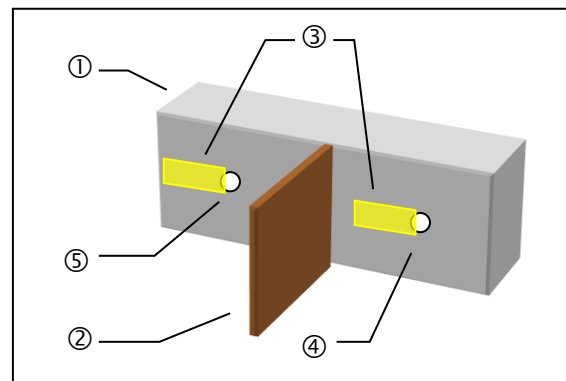


Fig.: 4.7-4: Representation of the reflector image for a triangulation angle clamped to the right.



See also the separate document „Setting Instructions PV1037/2“

4.8 Electrical connection

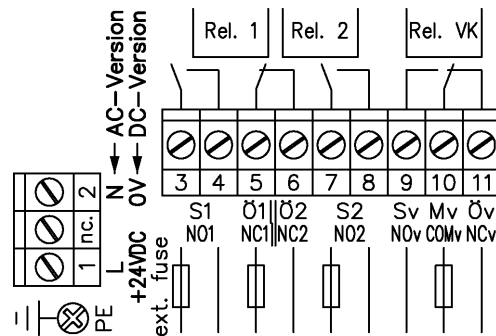









Fig.: 4.8: Connection diagram PV1037/2

Table 4.8

Terminal block	Naming	Function
1	L1 / +24V DC	Supply Version 'AC': L1 Version 'DC': + 24 V
2	N / 0V	Supply Version 'AC': N Version 'DC': 0 V
PE	PE	Protective earth conductor
3 & 4	NO ₁	Make contact (normally open contact) 1
5 & 6	NC ₁ NC ₂	Break contact
7 & 8	NO ₂	Make contact (normally open contact) 2
9 ... 11	NO _v /COM _v /NC _v	Dirt accumulation changeover contact (PV1037/2 only)

-  It is only allowed to control the crane movement by using the normally open contacts NO₁ & NO₂
-  The two separate normally open contacts NO₁ & NO₂ are provided to make a connection with a control device which may need two contacts for the switching function. If the following control unit does not need separated contacts then the normally open contacts NO₁ & NO₂ has to be connected in series.
-  The external power supply has to fulfill the rules for low voltage with safe isolation (SELV, PELV) in accordance with EN 60204-1.
-  A protective earth connection is essential for protection against electric shock from exposed conductive parts.
-  The normally closed contacts NC₁||NC₂ and the change-over contacts NO_v/COM_v/NC_v can be used for signaling purposes only just like a warning light or a warning flashlight.
-  To prevent any contact bonding a fuse corresponding to the maximum switching capacity of the utilization category has to be connected in line with each output contact (see chapter 3).
-  For switching inductive loads just like relays or contactors a spark extinction has to be connected parallel to the inductive load.
 AC: Spark extinction with RC-module
 DC: Spark extinction with flyback diode
 Notice: Spark extinction modules must not connected parallel to the output switches!

4.9 Applicable documents

Table 4.9

Indenture number	Model	Document type	Description	Document
5258	PV1037/2	Data sheet	Optical Anti-Collision Device with pollution warning output	E_52581.pdf
5258M01	PV1037/2*01	Data sheet	Optical Anti-Collision Device with pollution warning output	E_525811.pdf
5258 5258M01	PV1037/2 PV1037/2*01	Operating instructions	This document	E_52582.pdf
6801	4R100BL	Data sheet	Reflector for 25 m distance	E_68011.pdf
6801A01	4R100BLAF	Data sheet	Reflector for 25 m distance, anti-fogging version	E_68011.pdf
6802	18R100BL	Data sheet	Reflector for 50 m distance	E_68021.pdf
6802A01	18R100BLAF	Data sheet	Reflector for 50 m distance, anti-fogging version	E_68021.pdf
8683	JF152S	Data sheet	Adjustment flange for PV1037/2 and PV1037/2*01	E_86831.pdf
7111	JH1	Data sheet	Adjustment help	E_71111.pdf

5. Maintenance and cleaning

The optical surfaces and inspection of limit distances should only be performed by qualified technical personnel.

- Depending on the amount of dust occurring in the company, the optical surfaces of the distance monitoring system should be cleaned at suitable intervals. In addition to the lenses of the device the optical surfaces also include the reflectors.
- Depending on the amount of dust occurring in the company the function and the set clearance distance of the system should be checked by moving the cranes together. The inspection interval depends on the degree of contamination expected.
- In the case of outdoor applications measures should be taken to prevent dew collecting or ice forming on the reflector. Suitable are the reflectors 4R100BLAF or 18R100BLAF (catalog of applicable documents in section 4.9).

A soft, fluff-free cloth moistened with water should be used for cleaning. Where necessary a very small quantity of conventional washing-up liquid can be added to the clean water.



Do not use any cleaning agents containing alcohol or other solvents because they can ruin the function!



Avoid scratching the lens and reflectors.

A functional test should be carried out on the distance monitoring system after each cleaning procedure. This should include a check of the disconnection function at the fixed limit distances. Where necessary the distance monitoring system should be reset to the fixed limit distances.

6. Decommissioning

The device must be correctly disposed of at the end of its service life. When decommissioning please observe the local laws on the disposal of electronic equipment.

7. Spare parts

Table 7

Indenture number	Model	Description	Power supply
5258	PV1037/2	Optical Anti-Collision Device with pollution warning output, intended for clearance distances of up to 50 m	24VDC
			115VAC
			230VAC
5258M01	PV1037/2*01	Optical Anti-Collision Device with pollution warning output, intended for clearance distances of up to 25 m	24VDC
			115VAC
			230VAC
6801	4R100BL	Reflector for 25 m distance	
6801A01	4R100BLAF	Reflector for 25 m distance, anti-fogging version	
6802	18R100BL	Reflector for 50 m distance	
6802A01	18R100BLAF	Reflector for 50 m distance, anti-fogging version	
8683	JF152S	Adjustment flange for PV1037/2 and PV1037/2*01	
7111	JH1	Adjustment help	

Order data: Model; power supply

Example: PV1037/2 /230VAC

D-59368 Werne, 12.07.2023

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SRC: E_52582-2023-01.docx

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