


Operating Instructions

Optical Anti-Collision Device

Types PP1037/2 and PV1037/2

E_52572.pdf

<p>Features</p> <ul style="list-style-type: none"> ✓ Clearance distance of up to 45 m ✓ Greatest performance in terms of detection capability ✓ Pollution warning (only PV...) ✓ 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>
	

Revision index: 2018-12
 Revision date: 26.06.2018
 Processed by: tb

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	3
2.3 Safety information	4
3. Definitions – technical data	5
4. Operating instructions	6
4.1 Information on this technical description	6
4.2 Device description	6
4.3 Description of function	7
4.3.1 Triangulation triangle	7
4.3.2 Approach travel	7
4.3.3 Continually self-testing	8
4.3.4 Movement of the crane is possible	8
4.3.5 Movement of the crane is stopped	8
4.4 Dirt accumulation control function of Model PV1037/2	9
4.5 Assembly	9
4.5.1 Horizontal arrangement of the triangulation triangle	9
4.5.2 Distance monitoring accuracy	10
4.6 Information on assembly	11
4.7 Adjustment using the “light beam method”	12
4.8 Electrical connection	13
4.9 Applicable documents	14
5. Maintenance and cleaning	15
6. Decommissioning	15
7. Spare parts	16

1. Identification



1.1 Product versions / type plates

PP1037/2
PP1037/2*01
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
	Must know – Important information

2. Product description

2.1 Product mark

PP1037/2, PP1037/2*01, 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 PP1037/2 or 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 deployed as collision protection mechanism it can detect hazards triggered by approaching cranes and initiate a reduction in travel speed or bring the movement of the crane to a halt.

At least one device is required for each crane, while the corresponding reflector is positioned on the other crane.

2.3 Safety information

-  **System-related movement tolerances of crane system components and the possible associated effects on the switching behavior 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 function.**
-  **The set clearance distance could be reduced, e.g. by fog, steam, smoke, snowfall or rain.**
-  **During limited vision, e.g. caused by fog or steam, the function of the distance monitoring system should be checked.**
-  **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 operating 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 taken immediately 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.**
-  **The operator/installer 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**
-  **Further or supplementary protective measures may be required on the basis of risk assessments for special areas of application.**
-  **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 should 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.**
-  **If safety of machinery according to DIN EN 62061 and/or DIN EN ISO 13849 DIN is required, than our device CPV1037 should be used!**

3. Definitions – technical data

	PP1037/2	PP1037/2*01	PV1037/2	PV1037/2*01
Maximum clearance distance	45 m	25 m	45 m	25 m
Optical Systems	1			
Power supply / output or current consumption	(●: Option)			
230VAC ± 10 %	● / 10VA			
115VAC ± 10 %	● / 10VA			
42...48VAC ± 10 %	● / 10VA			
24VDC + 20 % / - 10%	● / ~ 350mA			
Connection	2 x cable glands; terminal strip			
Switching outputs				
Main contact	2 x relay NO contacts (250 VAC; 10mA...6A); supervised & force guided			
Status message	1 x relay NC contact (250 VAC; 10mA...6A)			
Pollution warning (when sighting reflector)	-	1 x relay change-over contact (250 VAC; 10mA...6A)		
Switching rate	Relay: 3/s			
Access time	≤ 80 ms			
Switching displays	2 x LED green			
Level indicator (for sighting reflector)	4 x LED red (DIANA)			
Transmitted light	LED, 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.		
Accessories				
Reflectors	<i>(recommended clearance distance)</i>			
7R50L	0,5 ... 25(45) m	1 ... 25 m	0,5 ... 25(45) m	1 ... 25 m
4R100BL, 4R100BLAF	0,5 ... 25 m	1 ... 25 m	0,5 ... 25 m	1 ... 25 m
18R100BL, 18R100BLAF	0,5 ... 45 m	1 ... 25 m	0,5 ... 45 m	1 ... 25 m
8R100BLH)	0,5 ... 35 m	1 ... 15 m	0,5 ... 35 m	1 ... 15 m
Adjustment flange	JF152S			

Re PP1037/2*01 and PV1037/2*01: devices 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 PP1037/2... and PV1037/2... distance monitoring systems. 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 PP1037/2... and 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 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 45 m and still have very considerable reserves in terms of function.

The integrated signal-emitting contamination evaluation of PV... 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 (45) m	350 mm x 100 mm	7R50L
up to 25 m	400 mm x 100 mm	4R100BL, 4R100BLAF
up to 45 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 \angle and
- from the width of the reflector = opposite leg to the angle \angle and
- from the outer light cone from the reflex light barrier = hypotenuse of the right-angled triangle.

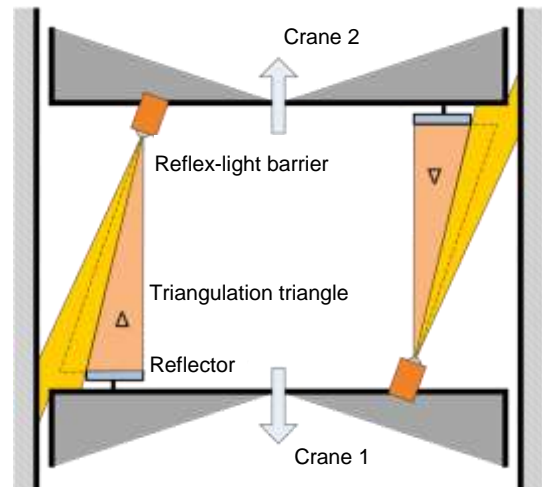


Fig.: 4.3.1

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.

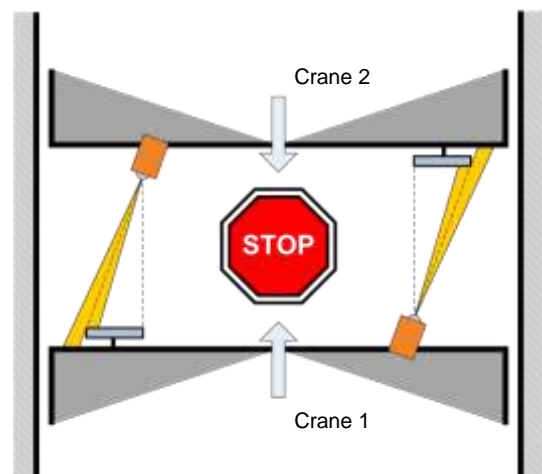


Fig.: 4.3.2

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 PP1037/2 or PV1037/2 systems must be installed or the PP1038/2 or PV1038/2 system must be deployed.

4.4 Dirt accumulation control function of Model PV1037/2

The optical Anti-Collision Device Type PV1037/2 is equipped with a 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. The distance monitoring system is mounted onto the crane using the JF152S adjustment flange. An imaginary line (④) that runs parallel to the crane track (⑤) connects the device on the right edge of the reflector (⑥). The angle (⑦) of the triangulation triangle should be selected such that the light barrier is pointing towards the left reflector edge when the limit distance is reached (⑧) (see also chapter on “adjustment”).

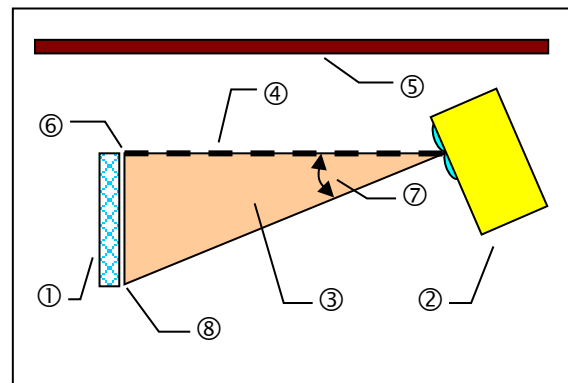


Fig.: 4.5.1-1: Example of a triangulation triangle clamped to the left

Reflector and reflex 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 reflex light barrier (②). The height of both parts should be taken from a common reference point (⑨).

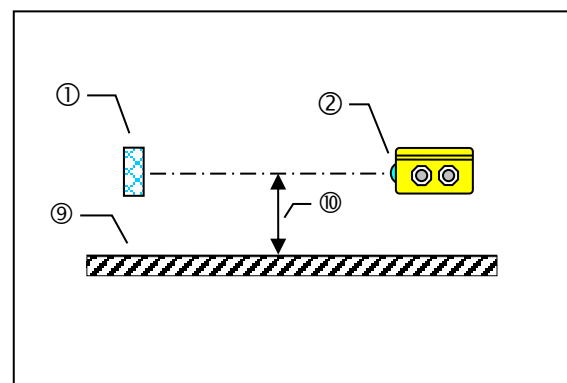


Fig.: 4.5.1-2



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.

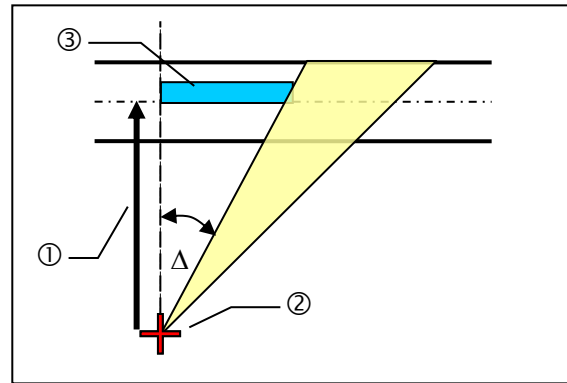


Fig.: 4.5.2-1: Set clearance distance

Lengthening the clearance distance

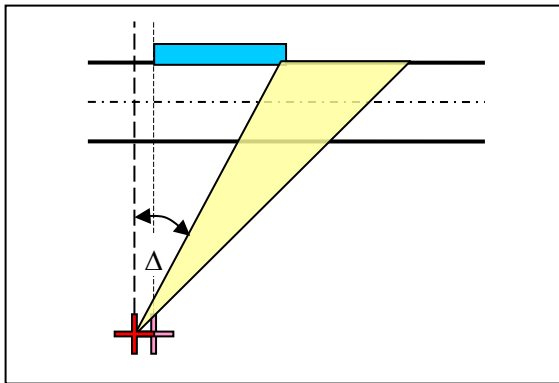


Fig.: 4.5.2-2: Shifting to the left

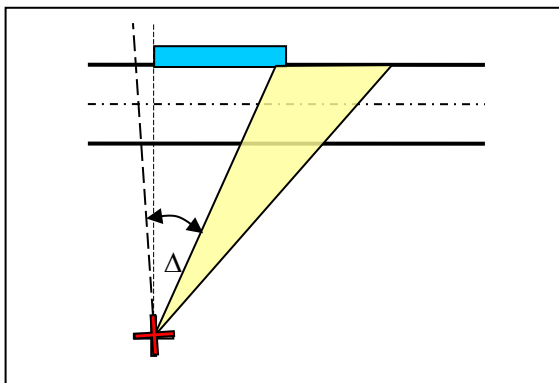


Fig.: 4.5.2-4: Rotation to the left

Shortening the clearance distance

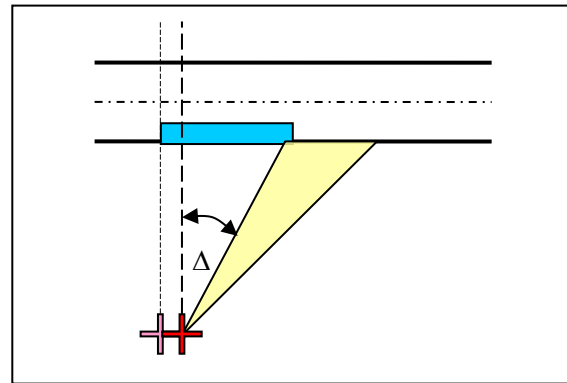


Fig.: 4.5.2-3: Shifting to the right

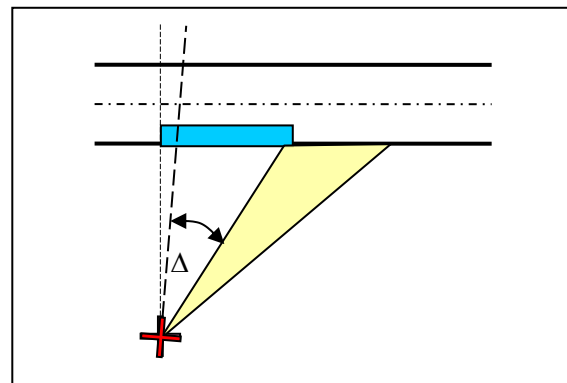


Fig.: 4.5.2-5: Rotation to the right



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 transducer benches have to be tightened with the fixing screws. 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.



Assembly may only be performed by a trained professional.



Two devices must never be mounted such that their optical devices are pointing straight at each other; any mutual influence that might alert the safety function must be excluded.



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



The reflector center on the other crane must be situated at the optical device (lens) level.



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.



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



The light beam of the system 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.



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



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



The set clearance distance should be tested and recorded.

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).

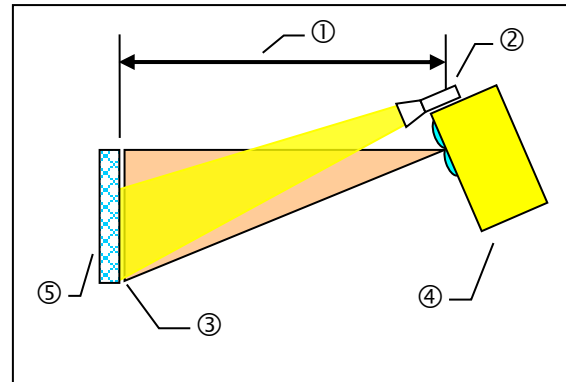


Fig.: 4.7-1

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).

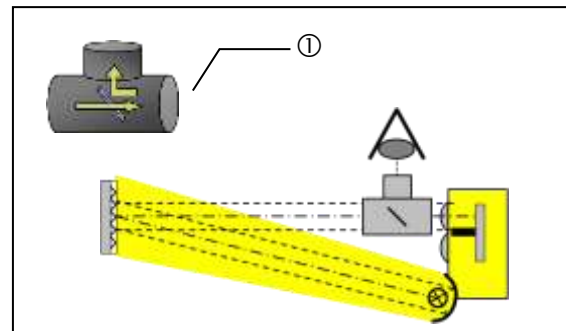


Fig.: 4.7-2

The vertical adjustment of the light barrier is set by means of the adjusting screw (①). The centre 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.

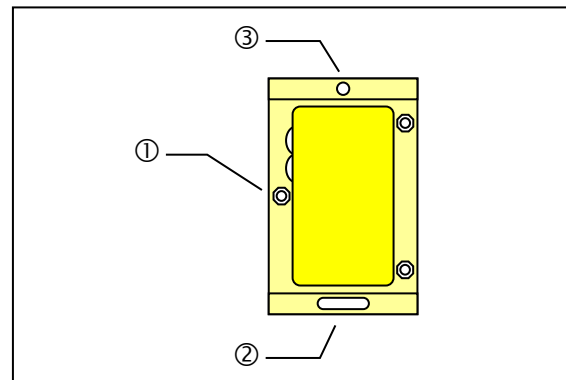


Fig.: 4.7-3

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.

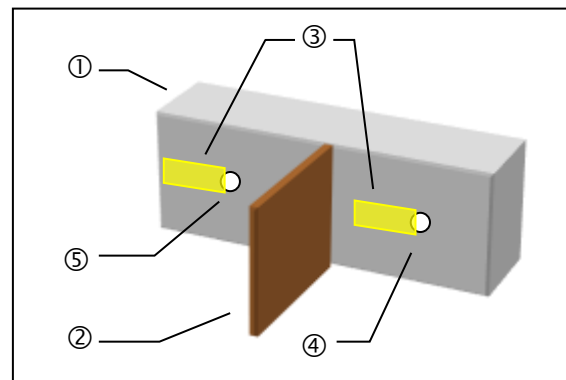


Fig.: 4.7-4: Representation of the reflector image for a triangulation angle clamped to the right.

4.8 Electrical connection

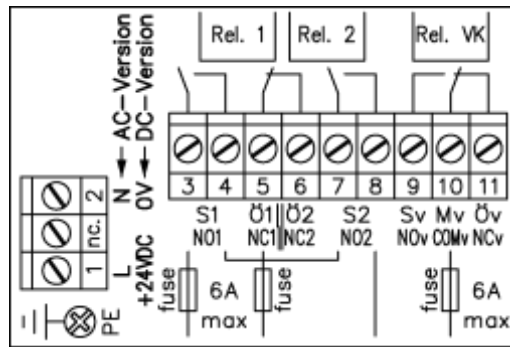


Fig.: 4.8: Connection diagram PP1037/2 & PV1037/2

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 with break down overcurrent of max. 6 A has to be connected in line with each output contact (please look to chapter 'technical data').



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
5257	PP1037/2	Data sheet	Optical Anti-Collision Device	E_52571.pdf
5257M01	PP1037/2*01	Data sheet	Optical Anti-Collision Device	E_525711.pdf
5258	PV1037/2	Data sheet	Optical Anti-Collision Device with pollution warning output	E_52571.pdf
5258M01	PV1037/2*01	Data sheet	Optical Anti-Collision Device with pollution warning output	E_525711.pdf
5257 5257M01 5258 5258M01	PP1037/2 PP1037/2*01 PV1037/2 PV1037/2*01	Operating instructions	This document	E_52572.pdf
6680	7R50L	Data sheet	Reflector for 25(45) m distance	E_66801.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 45 m distance	E_68021.pdf
6802A01	18R100BLAF	Data sheet	Reflector for 45 m distance, anti-fogging version	E_68021.pdf
6803	8R100BLH	Data sheet	Heatable reflector for 35/15 m distance	E_68031.pdf
6803	8R100BLH	Operating instructions	Heatable reflector for 35/15 m distance	E_68032.pdf
8683	JF152S	Data sheet	Adjustment flange for PP(PV)1037/2 and PP(PV)1037/2*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, 18R100BLAF or 8R100BLH (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
5257	PP1037/2	Optical Anti-Collision Device intended for clearance distances of up to 45 m	24VDC
			42 ... 48VAC
			115VAC
			230VAC
5257M01	PP1037/2*01	Optical Anti-Collision Device intended for clearance distances of up to 25 m	24VDC
			42 ... 48VAC
			115VAC
			230VAC
5258	PV1037/2	Optical Anti-Collision Device with pollution warning output, intended for clearance distances of up to 45 m	24VDC
			42 ... 48VAC
			115VAC
			230VAC
5258M01	PV1037/2*01	Optical Anti-Collision Device with pollution warning output, intended for clearance distances of up to 25 m	24VDC
			42 ... 48VAC
			115VAC
			230VAC
6680	7R50L	Reflector for 25(45) m distance	
6801	4R100BL	Reflector for 25 m distance	
6801A01	4R100BLAF	Reflector for 25 m distance, anti-fogging version	
6802	18R100BL	Reflector for 45 m distance	
6802A01	18R100BLAF	Reflector for 45 m distance, anti-fogging version	
6803	8R100BLH	Heatable reflector for 35/15 m distance	24VDC
8683	JF152S	Adjustment flange for PP1037/2, PP1037/2*01, PV1037/2 and PV1037/2*01	
7111	JH1	Adjustment help	

Order data:

Model; power supply

Example:

PV1037/2 /230VAC

D-59368 Werne, 26.06.2018

* 5257__*

SRC: E_52572-2018-12.docx

Fotoelektrik Pauly GmbH

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