Operating instructions

Optical Anti-Collision Device

Types PP1038/2 and PV1038/2

E_52672.pdf

Features

- ✓ Two optical systems in one enclosure
- ✓ Two independent clearance distances adjustable
- ✓ 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

Applications

- Collision protection
- Maintaining distance

with respect to cranes that run on a common crane track or rail.

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Table of Contents

1. Identification

1.1 Product versions / type plates

PP1038/2
PP1038/2*04
PV1038/2
PV1038/2*04

1.2 Name and address of the manufacturer

Fotoelektrik Pauly GmbH & Co. KG
Wahrbrink 6, 59368 Werne, Germany

2. Product description

2.1 Product mark

PP1038/2, PP1038/2*04, PV1038/2 and PV1038/2*04: 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 PP1038/2 or PV1038/2 System

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

Used as anti-collision and distancing equipment, it can detect hazards triggered by approaching cranes. The optical system adjusted to the far clearance distance can be used to reduce the cane's speed. The optical system adjusted to the shorter clearance distance can stop the crane moving.
At least one device is required for each crane, while the corresponding reflector is positioned on the other crane.

2.3 Safety information

- ☞ Further or supplementary protective measures may be required on the basis of risk assessments for special areas of application.
- ☞ If the device is operated in conjunction with other components such as control systems or sensors, the corresponding user information must be heeded.
- ☞ If forming condensation on the reflector surface cannot be excluded while an application with high humidity of the air or/and high valued and abruptly change in temperature. For that 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).
- ☞ The operator/installer must inform himself of the information that applies to his area of deployment and comply with this; this also applies to the installation to be performed and to the installation of cables and lines.
- ☞ The installation of the light barriers may only be performed by authorised technical personnel who have the requisite professional expertise to install electrical devices on crane systems.
- ☞ The device must be taken out of operation in the event of damage or leaks in the housing or in the cable and line entries.
- ☞ Requirements resulting from provisions relating to cranes must be applied under all circumstances.
- ☞ 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.
- ☞ Important notice:
  The set clearance distance could be reduced by fog, rain or snowfall.
- ☞ The light beam on the system must not be interrupted, for example by obstructions or suspended objects. Pay attention to this during assembly and when operating the system.
- ☞ A correct assembly and alignment of the system are essential for the correct operation of the system’s function.
- ☞ When starting the crane the function of the system should be checked by moving the cranes closer to each other.

3. Definitions – technical data

	PP1038/2	PP1038/2*04	PV1038/2	PV1038/2*04
Maximum clearance distance	45 m	25 m	45 m	25 m
Optcal Sytems	*2*			
Power supply / output or current consumption	*(●: Option)*			
230VAC ± 10 %	● / 16VA			
115VAC ± 10 %	● / 16VA			
42…48VAC ± 10 %	● / 16VA			
24VDC + 20 % / - 10%	● / ~ 700mA			
Connection	2 x cable glands; terminal strip			
Switching outputs				
Main contact	for each optical system: 2 x relay NO contacts (250/110 VAC; 6A; 1500VA/150W); supervised & force guided			
Status message	for each optical system: 1 x relay NC contact			
Pollution warning (when sighting reflector)	-		1 x relay change-over contact (250 VAC; 10 A; 2500VA)	
Switching rate	Relay: 3/s			
Access time	≤ 80 ms			
Switching displays	for each optical system: 2 x LED green			
Level indicator (for sighting reflector)	for each optical system: 4 x LED red (DIANA)			
Transmitted light	LED, 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	~ 3700 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	*(recommended clearance distance)*			
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	JF57S			

Re PP1038/2*04 and PV1038/2*04: 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 PP1038/2… and PV1038/2… 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. The PP1038/2… and PV1038/2… two-channel distancing system sets two definite clearance distances separately from each other. Each individual clearance distance is set in accordance with the triangulation principle.
The electronics for the two-channel reflex light barrier system are accommodated in an enclosure with IP 65 protection. There are two optical systems (channels) in the enclosure. The two optical systems can be set to different clearance distances independently of each other. Each individual clearance is set by means of a channel-specific spindle axle.
An adjustment flange is available for mounting the reflex light barrier. This enables fast and accurate assembly and alignment.
Each channel is assigned its own test unit. The internal test units generate continually defined light signals which impact on the receiving unit and simulates the light reflected by a 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.
When the set clearance distance is reached, the reflector on the opposite crane can be viewed. The view of the reflector and any internal component faults decisively alter the dynamic signal processing and accordingly slow down or stop the crane's movement. When farther clearance distance is reached, the crane's speed is slowed down. Once the nearer clearance distance is reached, the cane's movement is stopped (➔ halt state).
Each channel of 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 >Δ< and
- from the width of the reflector = opposite leg to the angle >Δ< and
- from the outer light cone form the reflex light barrier = hypotenuse of the right-angled triangle.

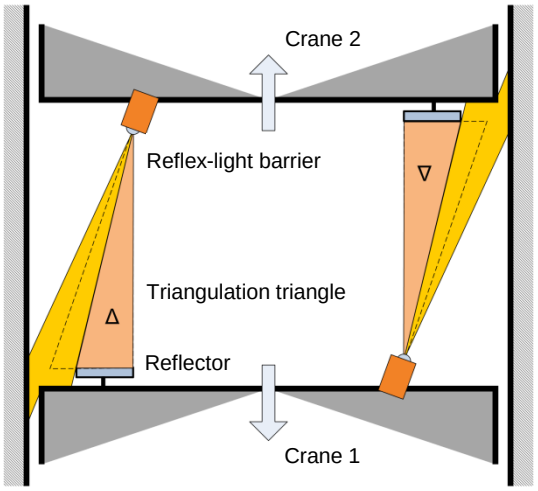

Fig.: 4.3.1

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 first channel in the reflex light barrier sights the reflector. The switching outputs of the first channel of the reflex light barrier are switched off – **pre-disconnection**.

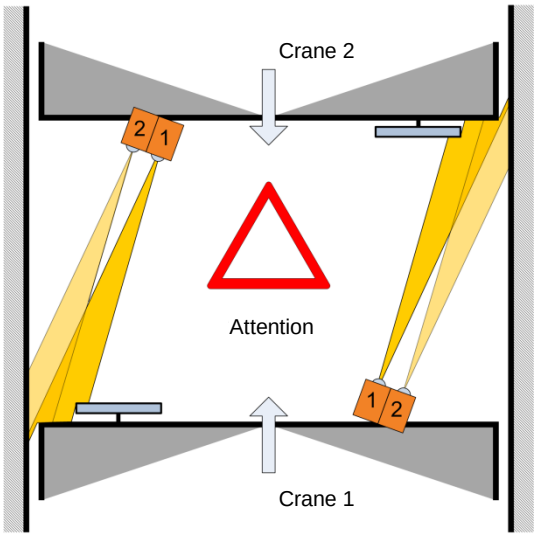

Fig.: 4.3.2-1

If the approach is continued and the second set clearance distance is reached, the second reflex light barrier illuminates the edge of the reflector. The switching outputs of the second channel in the reflex light barrier are switched off.

The crane travel is brought to a halt! The cranes are kept to 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.

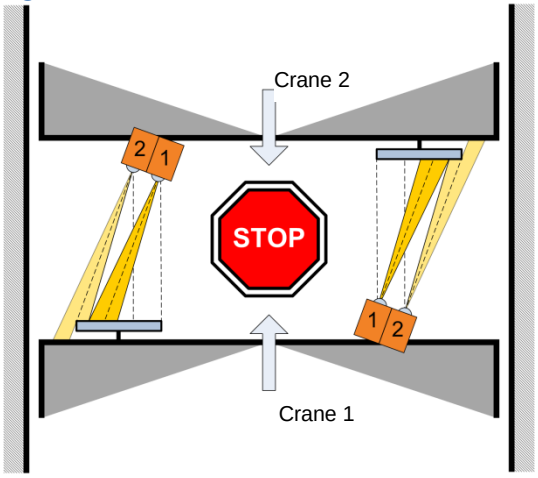

Fig.: 4.3.2-2

4.3.3 Continually self-testing

During the entire operation the light reflected by the reflector is reproduced by each internal test unit. Each test unit generates a modulated light signal and shines onto the own 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 barriers performs self-tests continuously.
If the reflector is not sighted and if no electronic faults are present, the NO contact 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 distances. The beams of the reflex light barriers past the reflector. There are no electronic faults.
Effect: The crane is cleared for movement. For each channel 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 visualize 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 first or second channel of the reflex light barrier.
Effect: The reflex light barrier sights its emitted light signal and switches the channel associated 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.
In accordance with its purpose, the two-channel system serves to influence the cranes movement by means of a pre-disconnection and a main disconnection. Once the first distance has been reached, the pre-disconnection typically slows down the crane movement while the crane movement is stopped once the main disconnection is reached.

4.4 Dirt accumulation control function of Model PV1038/2

The optical Anti-Collision Device Type PV1038/2 is equipped on both channels 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 JF57S 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”).

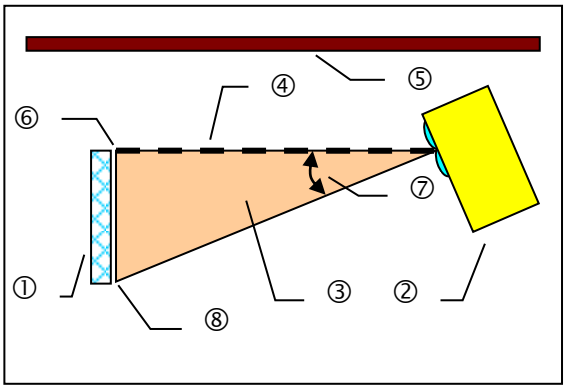

Fig.: 4.5.1-1: Example of a triangulation triangle clamped to the left

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).

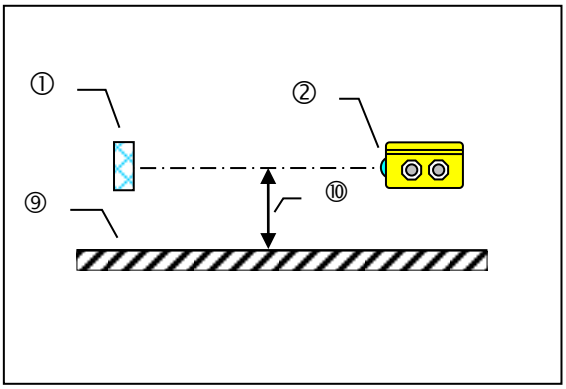

Fig.: 4.5.1-2

☞ It is essential to ensure that both optical channels 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.

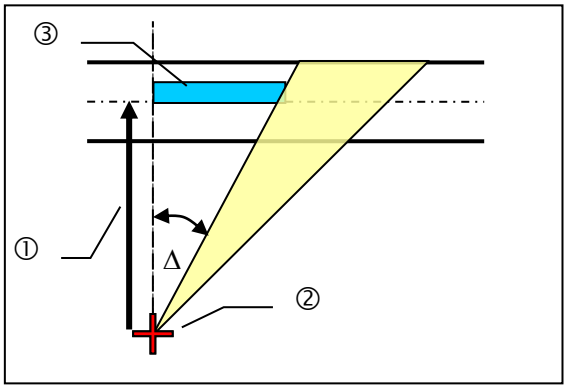

Fig.: 4.5.2-1: Set clearance distance

Lengthening the clearance distance

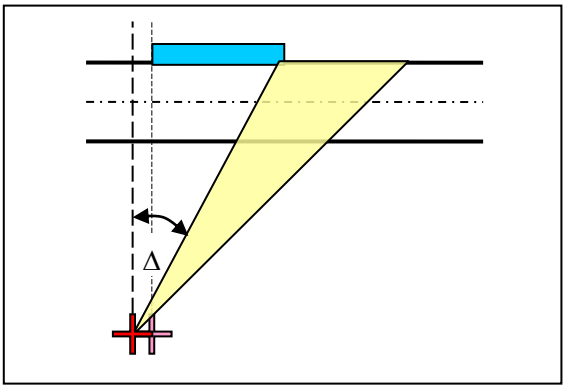

Fig.: 4.5.2-2: Shifting to the left

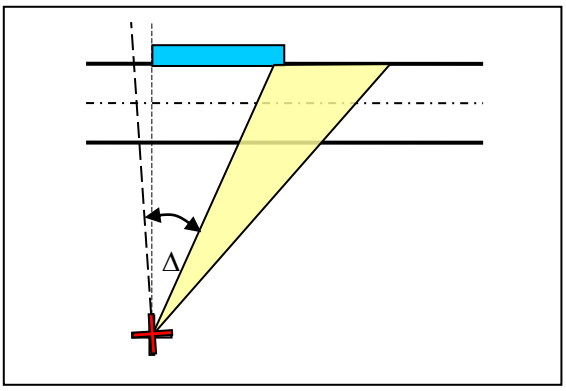

Fig.: 4.5.2-4: Rotation to the left

Shortening the clearance distance

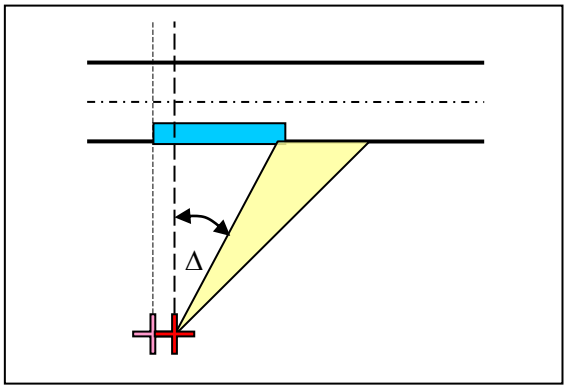

Fig.: 4.5.2-3: Shifting to the right

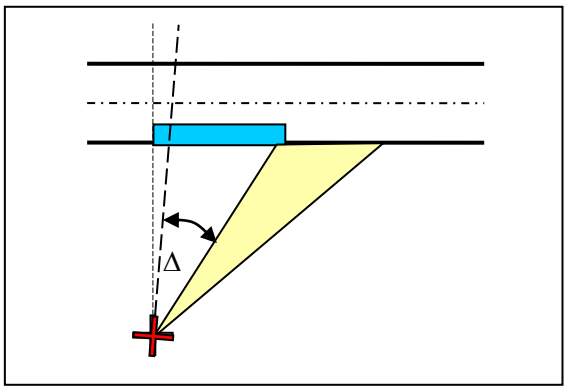

Fig.: 4.5.2-5: Rotation to the right

☞ 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

- ☞ Triangulation angle Δ should be set ≥ 1°.
- ☞ The reflector centre on the other crane must be situated at the optical device (lens) level.
- ☞ Two devices must never be mounted such that their optical devices are pointing straight at each other; any mutual influence that might alert the function must be excluded.
- ☞ Assembly may only be performed by a trained professional.
- ☞ The mounting has to be done that a misalignment caused by mechanical vibration or bumps could be excluded. After finishing the fine alignment the adjustment flange should be locked with the mounting surface, e.g. with. spring dowel sleeves close to each fastening hole.
- ☞ The reflector should be protected from contamination by suitable measures e.g. a protective housing.
- ☞ The set clearance distance should be tested and recorded.
- ☞ The reflector should be installed in non-accessible areas or must be concealed fixed.
- ☞ 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.
- ☞ 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.

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).

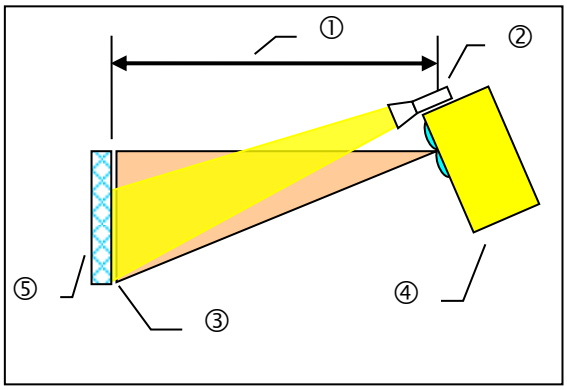

Fig.: 4.7-1

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).

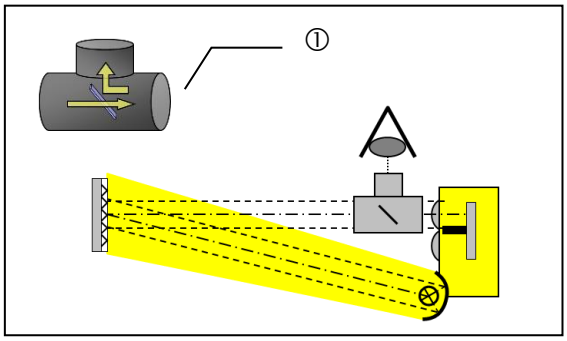

Fig.: 4.7-2

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 and ③) can be used to rotate the device at the horizontal level. Separately accessible spindle drives – behind the dummy screw (④) – can be used to set each individual optical system separately to a definite distancing range.

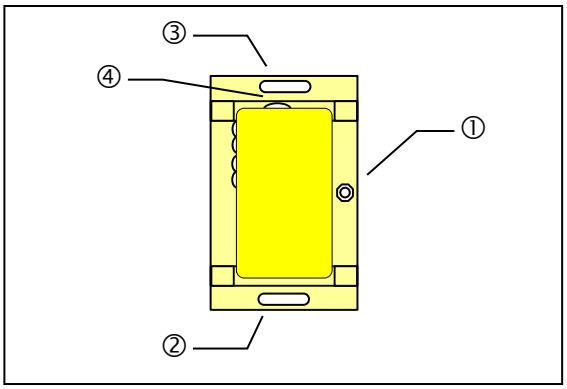

Fig.: 4.7-3

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.

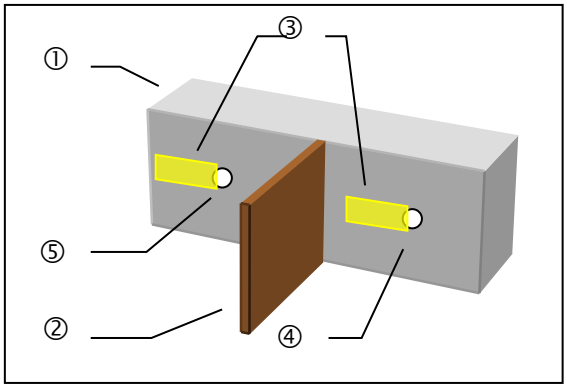

Fig.: 4.7-4: Representation of the reflector image for a triangulation angle clamped to the right.

4.8 Electrical connection

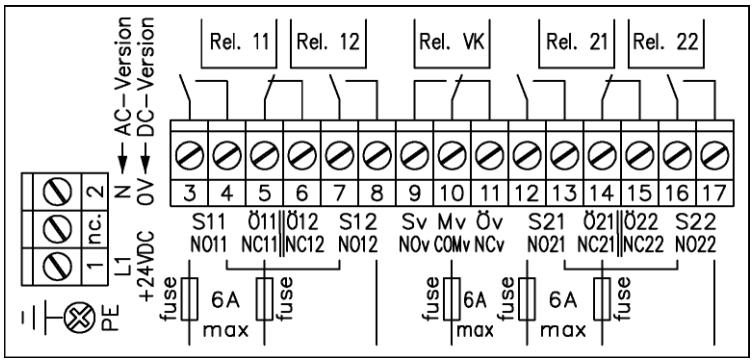

Fig.: 4.8: Connection diagram PP1038/2 & PV1038/2

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_{11}	Make contact (normally open contact) 1 of system 1
5 & 6	NC_{11}||NC_{12}	Break contact of system 1
7 & 8	NO_{12}	Make contact (normally open contact) 2 of system 1
9 … 11	NO_v/COM_v/NC_v	Dirt accumulation changeover contact (PV1038/2 only)
12 & 13	NO_{21}	Make contact (normally open contact) 1 of system 2
14 & 15	NC_{21}||NC_{22}	Break contact of system 2
16 & 17	NO_{22}	Make contact (normally open contact) 2 of system 2

☞ It is only allowed to control the crane movement by using the normally open contacts NO_{11} & NO_{12} (system 1) and NO_{21} & NO_{22} (system 2)

☞ The two separate normally open contacts NO_{11} & NO_{12} and NO_{21} & NO_{22} are provided to make a connection with a control device which may need two contacts for the function.

If the following control unit does not need separated contacts then the normally open contacts NO_{11} & NO_{12} and NO_{21} & NO_{22} has to be connected per system in series.

☞ The normally closed contacts NC_{11}||NC_{12} and NC_{21}||NC_{22} 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 recovery diode

Notice: Spark extinction modules must not connected parallel to the output switches!

☞ The external power supply should fulfill the rules for low voltage with safe isolation (SELV, PELV) in accordance with DIN EN 60204-1.

☞ A protective earth connection is essential for protection against electric shock from exposed conductive parts.

4.9 Applicable documents

Table 4.9

Indenture number	Model	Document type	Description
5267	PP1038/2	Data sheet	Optical Anti-Collision Device
5267M04	PP1038/2*04	Data sheet	Optical Anti-Collision Device
5268	PV1038/2	Data sheet	Optical Anti-Collision Device with pollution warning output
5268M04	PV1038/2*04	Data sheet	Optical Anti-Collision Device with pollution warning output
5267 5267M04 5268 5268M04	PP1038/2 PP1038/2*04 PV1038/2 PV1038/2*04	Operating instructions	This document
6680	7R50L	Data sheet	Reflector for 25(45) m distance
6801	4R100BL	Data sheet	Reflector for 25 m distance
6801A01	4R100BLAF	Data sheet	Reflector for 25 m distance, anti-fogging version
6802	18R100BL	Data sheet	Reflector for 45 m distance
6802A01	18R100BLAF	Data sheet	Reflector for 45 m distance, anti-fogging version
6803	8R100BLH	Data sheet	Heatable reflector for 35/15 m distance
6803	8R100BLH	Operating instructions	Heatable reflector for 35/15 m distance
8655	JF57S	Data sheet	Adjustment flange for PP(PV)1037/2 (*01) & PP(PV)1038/2 (*04)
7111	JH1	Data sheet	Adjustment help

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5. Maintenance and cleaning

The optical surfaces and inspection of linit 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 could destroy 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
5267	PP1038/2	Optical Anti-Collision Device intended for clearance distances of up to 45 m	24VDC
			42 ... 48VAC
			115VAC
			230VAC
5267M04	PP1038/2*04	Optical Anti-Collision Device intended for clearance distances of up to 25 m	24VDC
			42 ... 48VAC
			115VAC
			230VAC
5268	PV1038/2	Optical Anti-Collision Device with pollution warning output, intended for clearance distances of up to 45 m	24VDC
			42 ... 48VAC
			115VAC
			230VAC
5268M04	PV1038/2*04	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
8655	JF57S	Adjustment flange for PP(PV)1037/2, PP(PV)1037/2*01, PP(PV)1038/2 and PP(PV)1038/2*04	
7111	JH1	Adjustment help	

Order data:
Model; power supply

Example:
PV1038/2 /230VAC

D-59368 Werne, 26.10.2015
* 5267__*
SRC: E_52672-2015-10.docx