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Crane Anti-Collision Devices, Types PP1037/2-PV1037/2

Operating Instructions

1. Task

The crane anti-collision device, type PP1037/2 is designed as a protection against collision for cranes or other vehicles (e.g. larry cars) on a mutual craneway or rails. However, it is also suitable for ensuring that a minimum distance is maintained between two cranes, in order to avoid overloading the craneway. It recognises the dangerous approach of an oncoming crane and brings the crane to a halt.
A device is necessary for each crane, with a reflector mounted on the respective oncoming crane.
This device also provides limited protection for cranes on two craneways situated above one the other (in this case please contact us).

2. Description of the device

The crane anti-collision device consists of a reflector, of length 350 mm, type 7R50L, and a reflecting light barrier component in a waterproof housing (protection class IP65, not gas-tight; condensed water can be formed when a hot device (from operation) cools in an atmosphere with high humidity – therefore in case of doubt keep alive). The power supply, transmitting and receiving optical elements, evaluation electronics and switching outputs are located in this housing. The device is mounted on an adjustment flange JF152S, which facilitates installation and adjustment. A rain-proof roof is provided for outside operation. In this case, however, adjustment frame JF57Kr with adapter plate is required.
Through logically consistent use of a modular technique the device is very resistant to breakdowns, vibration, outside light and disturbances. Through its high power it can be used up to distance limits of 45 metres with adequate reserves. It is self-monitoring and the PV1037/2 model is fitted with a contamination control.

3. Mode of operation

A high performance reflex light barrier is directed, at an angle to the craneway, towards the reflector mounted on the oncoming crane. When both cranes have approached one another up to the limit distance the arrangement is represented by a right-angled triangulation triangle A*B*C*, with the hypotenuse (A*-B*) = light beam, cathetus (A*-C*) = reflector and cathetus (C*-B*) = parallel connecting line to the craneway, between the reflector end “C*” and the device optical unit “B*”.

4. Functional description

The mode of operation described under 3, in which viewing the reflector under the limit distances signals the approach of an oncoming crane, is logically explained in terms of the limited operating range of light barriers.
Therefore it is necessary for light barriers to prove that they are operable at crane distances above the limit distances:

Continuous function control of the optical and electronic components leads to switching on of the two relays 1 / 2 which mutually monitor one another. One green LED each permits a visual control over the switching state of the two relays. If both LED’s light up crane movement is completely free.

If the light beam falls on the reflector located on the oncoming crane, or if any component of the light barrier or the self-monitoring system does not function properly, the output relays are released; the green LED’s go out and crane movement is stopped.

5. Installation

The reflector and light barrier are mounted horizontally. The triangulation triangle is therefore also positioned horizontally in space. All descriptions refer to this position. The diagrams in the appendix always represent the view from above!
If the triangulation triangle is arranged vertically, only the reflector should be arranged in a position turned through 90°. For mechanical reasons the light barrier itself should be installed horizontally. As a consequence of this the adjustment directions of the long hole fixture D-E and the adjusting screw C change their direction functions with one another and the adjusting screw C probably does not provide sufficient correcting displacement. Please enquire if necessary.
The crane anti-collision device PP1037/2 is mounted on the crane using adjustment flange JF152S, in such a way that an imaginary connection between the device and the reflector end "C*" runs parallel to the craneway. However, the reflector end "A*" must be positioned within the "line of vision" of the device at the limit distance. The "basic inclination" of the device must be determined using the procedure described under 6, and it should be screwed on in this position. Pinning to the mounting base should not be carried out until possible correction with the long hole fixture D and E has been carried out.
The optical systems are designed in such a way that non-reflecting surfaces can easily be recognised up to a distance of 5 metres, depending on the degree of absorption. Therefore care should be taken that such surfaces do not influence the crane movement by arranging the device in a suitable way.
This "scanning behaviour" is intentional since in case of doubt even a contaminated reflector can still be recognised up to a certain degree.
If this scanning behaviour is disturbing, as is conceivable for example when the device is used in narrow storage lanes, please contact us. A modified optical system can remedy the problem.

- **It is absolutely essential to ensure that both optic pairs still have a view of the reflector even when both cranes have been brought together up to the buffer distance.**
- **The reflector on the oncoming crane must be fitted at the height of the optical unit.**
- **Two devices must never be installed in such a way that their optical units face one another.**

6. Adjustment

Both cranes are transported to the limit distance. To carry out the adjustment the reflector end "A*" is illuminated with a strong lamp, which is positioned close to the optical unit.
With the device cover opened, each of two more or less bright reflex images of the reflector can be seen on the transducer bench (the aluminium plate with two drill holes which is located behind the lenses, in which the working photo diodes are situated).
The light barrier should be adjusted by means of the adjusting screw C (see appendix) in such a way that the reflector images are positioned centrally at the height of the transducer drill holes. With the long hole fixture D-E the device is turned round its vertical axis until the narrow edges of the two reflector projections on the transducer bench are positioned approximately in the centre of the drill hole. The green LED's must be switched off. Now turn the device outwards (in the diagram in the appendix counterclockwise) until the LED's switch on, and then carefully turn back again until the LED's just switch off again. Screw tightly in this position and pin to the mounting base. A test run is carried out with both cranes to confirm that they switch off when the required limit distance has been reached.
Please note that the reflector images on the transducer benches appear to be on the wrong side. This is owing to the image forming characteristics of optical lenses.

7. Electrical connection

The operating voltage should be applied to terminals 1 and 2; the protective earthed conductor should be connected to an inner housing screw.
At 230 VAC terminals B and C are bridged. At 115 VAC terminals A and C, as well as B and D are bridged. 24 VDC is special equipment.
Crane travel should be influenced only by the normally open contact pair S_1/S_2 (class 3 / 4 and 7 / 8). S_1 should be connected in series with S_2 unless an external switching device as an extension to the self-monitoring system is used, which requires two electrically isolated NO contacts.

The normally closed contact pairs $Ö_1/Ö_2$ (class 5/6) should be used only for signalling purposes, except in special test circuits (switching on testing).
The contacts should be suitably fused (6 A max.)
System testing does not require an additional circuit (as for example with PP1027 or PP1028). This is carried out continuously and automatically.

8. Special equipment

a) "A", external test equipment

The external test equipment effectively monitors the degree of contamination of the optical units (as well as of the test transmitter).
If the light transmitting capacity of the optical units drops below a certain minimum value the output relays are released.
To remedy this the optical units, test equipment and particularly the reflector should be cleaned with a soft, damp (but not wet) cloth. Scratching of the optical components, particularly the reflector, should be avoided.

b) "s", sabotage protection

The sabotage protection device enables manipulation or accidental covering up of the optical units (lenses) of the device to be effectively detected / prevented.
A diffuse transmitter light "cloud", which surrounds the outside of the optical units in the form of a light fog, reflects this radiation into the receiver optical unit as soon as objects are situated directly in front of the optical unit (e.g. a cleaning cloth on the lense). If the device detects this special transmitted light the output relays are released.

c) "i", DIANA

DIANA is an array of 4 LED's which begin to light up one after the other as the intensity of the optical signal on the working receiver increases. At the same time the luminosity of the individual LED's also increases (**Di**gital-**An**alogue-Indicator).
The total lift of the 4 LED's is approx. 20:1, related to the response threshold. Within its working range DIANA can convey a good idea of the power and response status of the working and contamination warning receiver (--PV1037/2) with regard to both the test and reflector signal. Thus it acts as an adjustment aid for the reflector and also possibly for the potentiometer "test level" (should be adjusted only in an emergency) and VK (sensitivity of the contamination warning contact).

The DIANA switch allocates the DIANA level indicator alternatively to the pure reflector signal or to the test signal:
"Operation" position: signal intensity when reflector visible. Serves both for adjusting the response level of the contamination warning contact (model –PV1037/2; the test signal is blanked in this position) and for adjusting to the reflector. If the DIANA operating range is exhausted owing to high signal intensity (all 4 LED's light up brightly), the power can be reduced by partly covering up one lens system, so that DIANA's illumination is weaker. Then by observing DIANA a new attempt can be made to further optimise alignment to the reflector at the limit distance.

Normal adjustment

"Test" position: The test signal is indicated without sight of the reflector. Generally all four LED's light up. If less than two LED's light up the test level can be readjusted with the "test level" potentiometer, to such an extent that more DIANA-LED's light up again – but only so far that the fourth LED is just fairly visible (otherwise there is a risk of overloading). When the reflector is in view, its signal proportion is added to this.

- **Perfect functioning does ***not*** depend on all 4 DIANA-LED's lighting up.**

d) PV1037/2, with contamination warning contact VK

This variant is always equipped with DIANA. The response level of VK can be adjusted with the VK potentiometer in such a way that it is higher than that of the working receiver by a factor of 2 to infinity. For this purpose a power status is adjusted, with the reflector in view, at which the first LED from DIANA lights up but the second just does not (approx. 4 – 5 fold level above the response threshold). The potentiometer VK is now regulated so that the LED VK is just extinguished.

- **The less sensitive the adjustment of VK, the smaller is the total extent of contamination of the reflector and optical units when VK responds. This means frequent signalling of contamination.**

The relay which signals warning of contamination can be adjusted, time-delayed, up to approx. 5 sec by means of potentiometer PZ. The time adjustment depends on the follow-up travelling path of the crane after switching off (reflector has been sighted).
If when the reflector is sighted the follow-up travelling time is longer than the set time then any contamination which has already been signalled can be erased. The reason for this is that as the cranes approach more closely the amplifier with a weaker adjustment may also possibly recognise the reflector again.
On the other hand with very slow movement of the cranes, or extremely short stopping times, the contamination indicator may come into operation every time when the reflector is sighted.
After the limit distance has been left behind the signal is deleted, unless the power of the test system is no longer sufficient.
The changeover contact of the VK relay is connected to terminals 9, 10 and 11, and is generally used to switch on a signalling light – if necessary via a contactor which goes to self-holding.

9. Potentiometer

The potentiometer AK is normally set to maximum power. In rare cases it may appear necessary to reduce the power somewhat in order to reduce possible reflections on the hall walls etc. (see section 2). Power reduction of maximum 50% (limited owing to circuit compulsion) is possible.
The adjustment of the two “test cycle” potentiometers must never be changed!

10. Series contact

If a second switching point is required, types PP1038/2 or PV1038/2 are recommended, or a second device, PP1037/2 or PV1037/2, can be used. A second reflector is not absolutely essential.