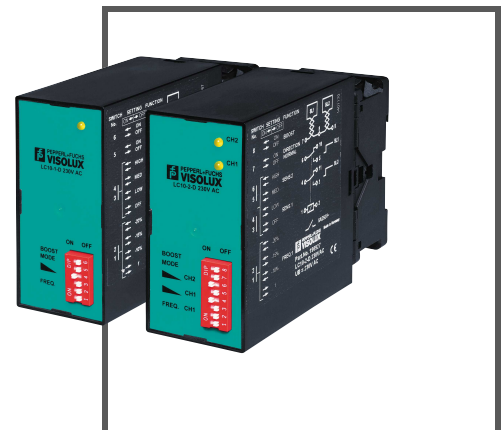


MANUAL

LC10-*

Laying loops for Loop detector LC10-1 and LC10-2



With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"

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1 Introduction

1.1 Contents

This document contains information that you need in order to use your product throughout the applicable stages of the product life cycle. These can include the following:

- Product identification
- Delivery, transport, and storage
- Mounting and installation
- Commissioning and operation
- Maintenance and repair
- Troubleshooting
- Dismounting
- Disposal



Note!

This document does not substitute the instruction manual.



Note!

For full information on the product, refer to the instruction manual and further documentation on the Internet at www.pepperl-fuchs.com.

The documentation consists of the following parts:

- Present document
- Instruction manual
- Datasheet

Additionally, the following parts may belong to the documentation, if applicable:

- EU-type examination certificate
- EU declaration of conformity
- Attestation of conformity
- Certificates
- Control drawings
- Additional documents

1.2 Target Group, Personnel

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismounting lies with the plant operator.

Only appropriately trained and qualified personnel may carry out mounting, installation, commissioning, operation, maintenance, and dismounting of the product. The personnel must have read and understood the instruction manual and the further documentation.

Prior to using the product make yourself familiar with it. Read the document carefully.

1.3 Symbols Used

This document contains symbols for the identification of warning messages and of informative messages.

Warning Messages

You will find warning messages, whenever dangers may arise from your actions. It is mandatory that you observe these warning messages for your personal safety and in order to avoid property damage.

Depending on the risk level, the warning messages are displayed in descending order as follows:



Danger!

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.



Warning!

This symbol indicates a possible fault or danger.

Non-observance may cause personal injury or serious property damage.



Caution!

This symbol indicates a possible fault.

Non-observance could interrupt the device and any connected systems and plants, or result in their complete failure.

Informative Symbols



Note!

This symbol brings important information to your attention.



Action

This symbol indicates a paragraph with instructions. You are prompted to perform an action or a sequence of actions.



2 General safety instructions



Note!

Read the operating instructions before attempting commissioning.



Caution!

Installation, connection and adjustments should only be undertaken by specialist personnel.



Warning!

No safety component for protection of personnel or EMERGENCY-STOP functions.

Directives and Standards

EU-Directive	Standards
2014/30/EU	EN 61000-6-2:2005 EN 61000-6-4:20071A1 :2011
2014/35/EU	EN 60204-1 :20061A 1:2009

3 Product Description

3.1 Overview

Together with the inductive loops laid beneath the surface, the LC series loop detectors form a universal sensor system for detecting vehicles. People are not detected. Vehicles that enter the inductive loop change the resonant frequency. This frequency change is measured and analyzed by the microprocessor in the LC10 loop detector. The analysis is automatically and periodically adjusted to the respective loop, ensuring that any changes in the loop inductance caused by temperature, humidity or component age are automatically compensated for.

The loop detectors are control units that are fully functional without the need for any other auxiliary equipment once the power supply and an inductive loop have been connected. The inductive loop laid below the surface forms the inductor of a high-frequency oscillating circuit. The metal parts of a vehicle that enters or is located in this wired loop cause the frequency of the oscillation circuit to change. This frequency change is analyzed by the loop detector, and the outputs, which are zero-potential relay contacts, can switch. The switching outputs are relay contacts with a high switching power that can directly control contactors, valves and alternating current motors. The dimensions of the detection area can be adjusted by changing the size and shape of the inductive loops.



Figure 3.1 LC10-1 (left) and LC10-2 (right) loop detectors

3.2 Use and Application

Possible areas of application for the LC10-* series loop detectors are:

- Selective vehicle detection
- Opening impulse sensor for automatic gates and barrier systems
- Presence checks for vehicles
- Direction-specific vehicle checks
- Controlling traffic light and vehicle detection systems
- Ticket detection in parking garages
- Managing tasks in automatic conveyor systems

3.3 Indicators and Operating Controls

3.3.1 LC10-1-*



- 1 LED indicator
- 2 DIP switch

LED indicator

LED signals the allocation state of the loop (Loop allocated = LED On). A fault in the loop due to a short-circuit or lead breakage and loop inductance outside the permissible range is indicated by flashing of LED.

DIP switches

It is possible to modify frequency, sensitivity and operating mode by using the DIP switch.

Sensitivity

The response sensitivity of the loop detector can be set in three stages by switches 3 and 4.

switch 3	switch 4	sensitivity
OFF	ON	low
ON	OFF	medium
ON	ON	high

Table 3.1 In the switch position "OFF", "OFF" the loop evaluation is switched off.

Frequency switches

The loop frequency can be set in four stages using the switches 1 and 2.

switch 1	switch 2	frequency
OFF	OFF	basic frequency f
ON	OFF	f - 10%
OFF	ON	f - 15%
ON	ON	f - 20%

Table 3.2 After actuation of the frequency switches 1 and 2 the loop must be readjusted with switches 3 and 4 set to "OFF", "OFF".

Operating mode switches

The following operating modes can be set with switches 5 and 6:

switch 7	switch 8	result
OFF	-	Pulse (0,8 s) when loop is allocated
ON	-	Pulse (0,8 s) when loop is abandoned
-	ON	Increased sensitivity (Boost)

Table 3.3 The increased sensitivity (Boost) is used for the detection of vehicles with high body assemblies, e.g. HGVs.

3.3.2 LC10-2-*



- 1 LED indicator loop 2
- 2 LED indicator loop 1
- 3 DIP switch

LED indicators

Indications: LEDs 1 and 2 signal the allocation state of the loops (Loop 1 allocated = LED 1 on, Loop 2 allocated = LED 2 on).

A fault in a loop due to a short-circuit or lead breakage and loop inductance outside the permissible range is indicated by flashing of the respective LED.

DIP switches

It is possible to modify frequency, sensitivity and operating mode by using the DIP switch.

Sensitivity

The response sensitivity of the loop detector can be set in three stages using switches 3 and 4 (for loop 1) and switches 5 and 6 (for loop 2).

switch 3 or 5	switch 4 or 6	sensitivity
OFF	ON	low
ON	OFF	medium
ON	ON	high

Table 3.4 In the switch position "OFF", "OFF" the loop evaluation is switched off.

Frequency switches

The loop frequency can be set in four stages using the switches 1 and 2.

switch 1	switch 2	frequency
OFF	OFF	basic frequency f
ON	OFF	f - 10%
OFF	ON	f - 15%
ON	ON	f - 20%

Table 3.5 After actuation of the frequency switches 1 and 2 the loop must be readjusted with switches 3 and 4 set to "OFF", "OFF".

operating mode switches

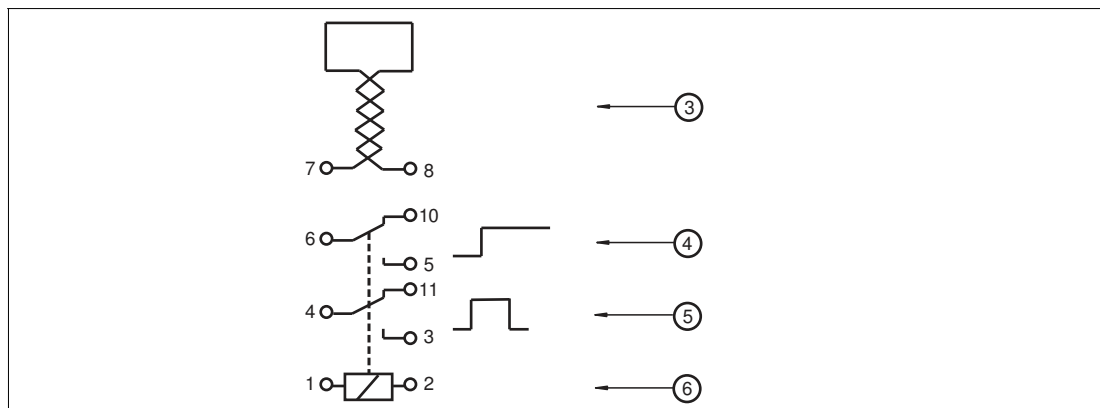
The following operating modes can be set with switches 7 and 8:

switch 7	switch 8	result
OFF	-	Output of the loop allocation status
ON	-	Direction detection*
-	ON	Increased sensitivity (Boost)

Table 3.6 *A signal is output, depending on the allocation sequence of the loops. If loop 1 is allocated before loop 2, only one switch signal is output for loop 1. The signal output for loop 2 remains inhibited until both loops are free again. If loop 2 is allocated before 1, only one switch signal is output for loop 2. The signal output for loop 1 remains inhibited until both loops are free again.
The increased sensitivity (Boost) is used for the detection of vehicles with high body assemblies, e.g. HGVs.

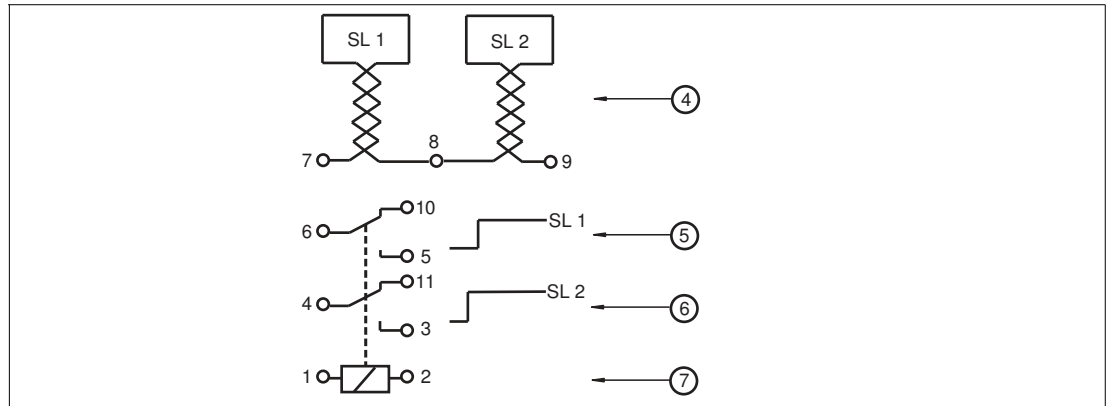
3.4 Interfaces and connections

Connections LC10-1



Number	Explanation	Connector terminals
3	Loop connection	7/8
4	Signal output, maintained contact	5/6 = NO 6/10 = NC
5	signal output,	3/4 = NO 4/11 = NC
6	Operating voltage	1/2

Connections LC10-2



Number	Explanation	Connector terminals
4	Loop connection, Loops 1/2	7/8 = loop 1 8/9 = loop 2
5	Signal output, Loop 1	5/6 = NO 6/10 = NC
6	Signal output, Loop 2	3/4 = NO 4/11 = NC
7	Operating voltage	1/2

3.5

Dimensions

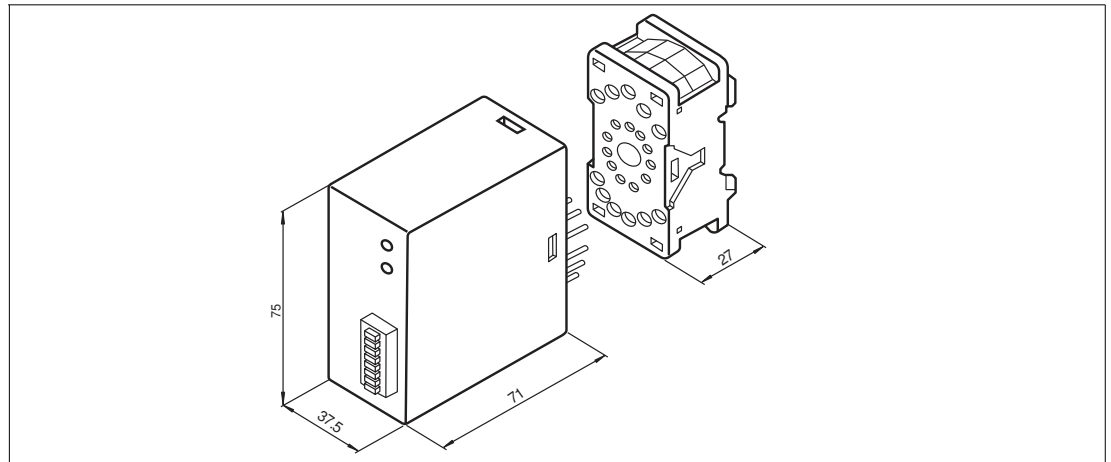


Figure 3.2 Dimensions LC10-1 and LC10-2

4 Installation

4.1 Preparation

4.1.1 Laying loops

Laying loops in asphalt or concrete floors

When laying loops in asphalt or concrete floors the loop can be produced in commercial grade insulated copper braid HO7V-K1.5(NYAF) with a cross section of 1.5 mm².

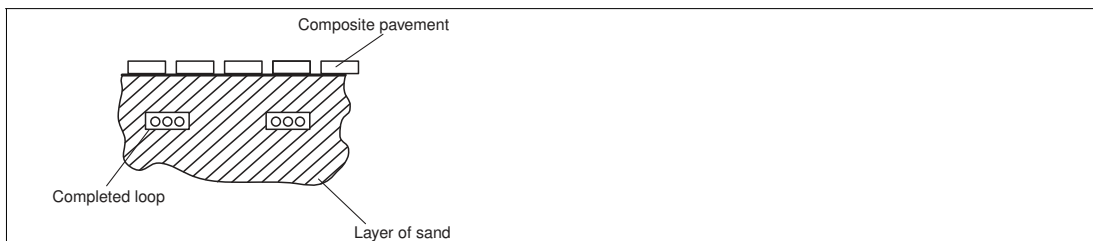
A groove approx. 8 mm wide and 30 - 40 mm deep is cut into the floor. The groove must be cleared of all residue and the wires of the loop inserted as deep as possible and fixed in place. The groove is then refilled with artificial resin or bitumen.

The connection lead for the loop is twisted (at least 20 times per meter) and then also laid in a groove or a conduit to the loop detector. The connection lead should not exceed a length of max. 150 m.



Laying loops under composite paving

When laying loops under composite paving the loop must be laid permanently in a plastic pipe in a sand bed. We recommend to lay the loops in a plastic conduit. The loop must not be laid in groove cut into the composite paving.



4.1.2 Number of loop windings

The induction loop consists of several copper wire windings which are inserted into the floor groove. The number of windings depends on the size of the loop and can be calculated from the loop circumference in accordance with the following table. Loop circumference **U**:

$$U=2a+2b$$



Figure 4.1 e.g.: a = 3 m; b = 1 m; $U = 2 \times 3 \text{ m} + 2 \times 1 \text{ m} = 8 \text{ m}$; Number of windings = 4

Loop circumference	Number of windings
2 - 4 meters	6
4 - 7 meters	5
8 - 12 meters	4
13 - 25 meters	3

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Adjacent loops of the same circumference should differ from each other by 1 winding. This prevents the loops from operating on the same frequency.

4.1.3 Loop test

After laying and sealing the insulating resistance of the loop must be measured against earth. It must be at least 1 MOhm.

Important notice!

1. When laying in asphalt/concrete the loop must be buried deep enough not to be pressed back out under driving load.
2. Twist the loop connection lead well (at least 20 times per meter) and lay permanently.
3. Firmly embed the loop and the connection lead. Loop movements can result in false alarms.
4. Solder the connection points in the loop connection lead and insulate them well (e.g. distribution box + sealing)
5. Lay loop connection lead separately from high voltage cables.
6. Lead the connection lead also twisted in the switch cabinet up to the terminals of the loop detector.
7. Do not lead loops over resistance mats of floor heating installations.

4.2 Installation

Installation LC10-*

The loop detectors are constructed within the 11-pole plug-in socket housing and can be installed directly in switch cabinets. They can be fixed either on a 35 mm top hat rail or via screw connections. Direct installation at the induction loop on location is also possible through integration in an ISO housing. This method of installation is recommended for long loop connection leads.

During switch cabinet installation care must be taken not to install the loop detectors directly next to switch contactors for high voltage consumers in order to prevent interference.

Connection LC10-*

Loop detectors are control devices which are fully ready for operation without the need for additional equipment when connected to the supply voltage and the induction loop. The switching outputs are relay contacts with high breaking capacity which can directly trigger contactors, valves and alternate current motors.

To reduce potential interference it is recommended to fit inductive consumers with R/C protective circuits (47 Ohm / 0.1 µF).

The loop connection lead must be well twisted (at least 20 times per meter) all the way to the connection terminals of the loop detector. The loop connection lead must be laid separately from switching cables of high voltage consumers (not in the same cable conduit).

The proper design and correct laying of the loop are preconditions for the proper functioning of the loop detector.

5 Commissioning

When the operating voltage is applied to the device automatic adjustment with the loop takes place. The output relays are switched in the switch position "loop not allocated". The adjustment takes 2 s, then the device is ready for operation. Automatic adjustment also takes place when both sensitivity switches 3 and 4 (Loop 1) and 5 and 6 (Loop 2) are set to "OFF" and then set to another switch position. The adjustment can be carried out separately for loop 1 and loop 2.

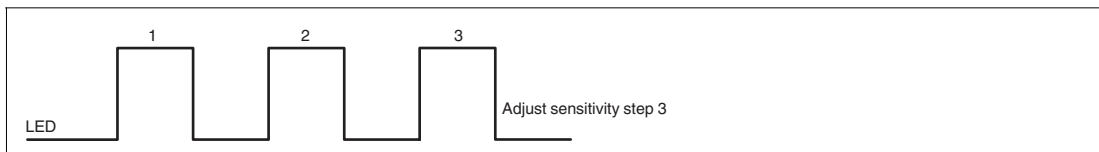
5.1 Test function

The loop detector is provided with an integrated test function, which enables the loop frequency and sensitivity to be optimally set without additional devices or instrumentation.

Display of the recommended sensitivity

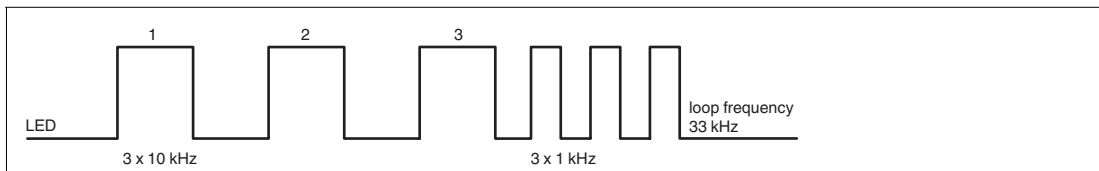
The vehicle must be driven onto the loop. The loop detector measures and stores the frequency change. When switches 3 and 4 are changed over the recommended sensitivity is indicated by flashing of LED 1 (Loop 1).

In addition to LC10-2: When switches 5 and 6 are changed over the recommended sensitivity is indicated by flashing of LED 2 (Loop 2).



Measurement of the loop frequency

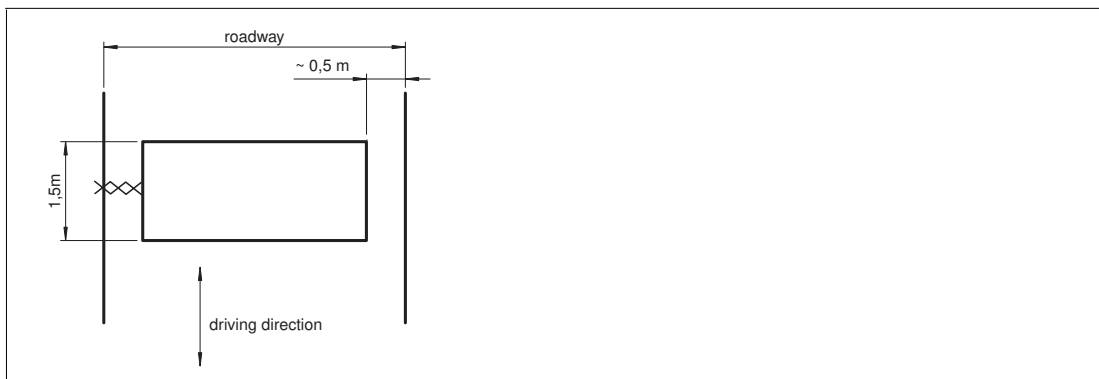
The loop frequency can be measured via the LED. Set switches 3 and 4 from "OFF" to "ON". The LED indicates the loop frequency via a signal sequence:



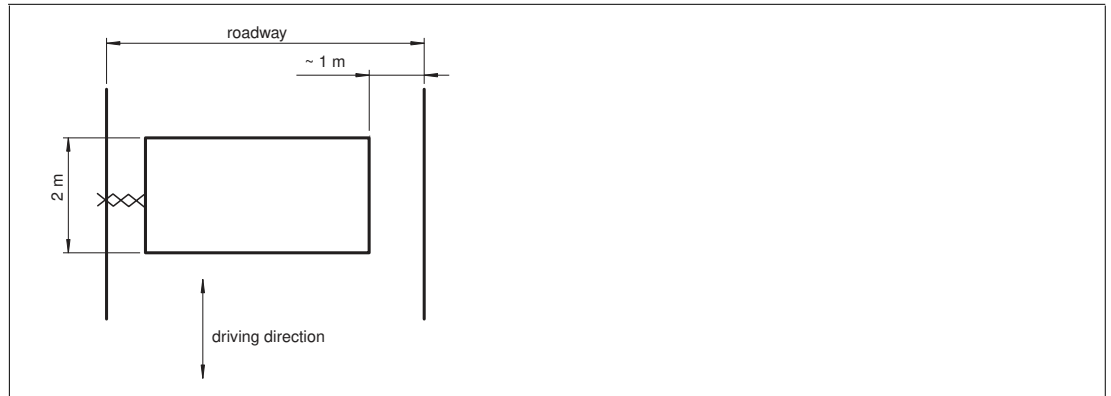
5.2 Loop geometry

The size and shape of the loop are determined by the respective application. Generally, the maximum sensitivity of the induction loop is achieved if the loop is no larger than the vehicle to be detected. This principle must in particular be observed if the sensitivity is reduced by steel reinforcements within the floor.

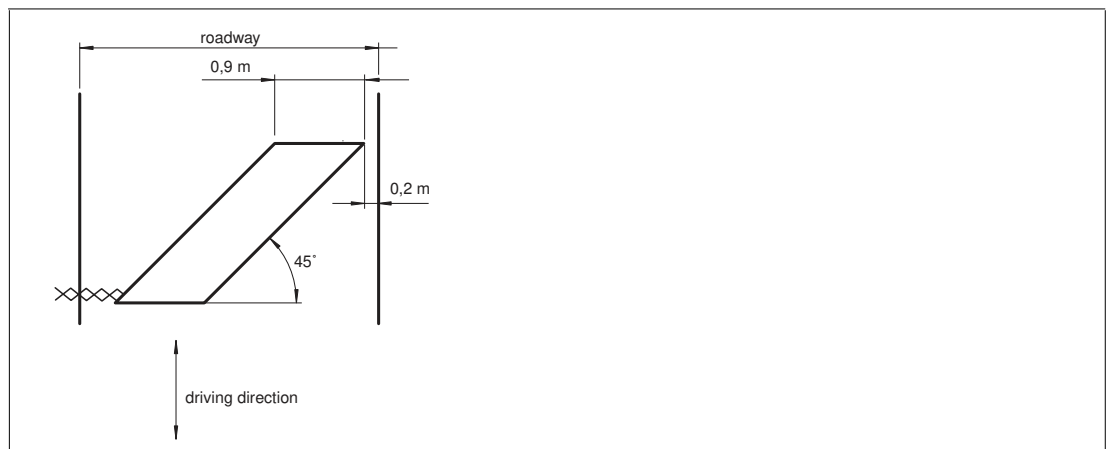
Detection of passenger cars and forklifts



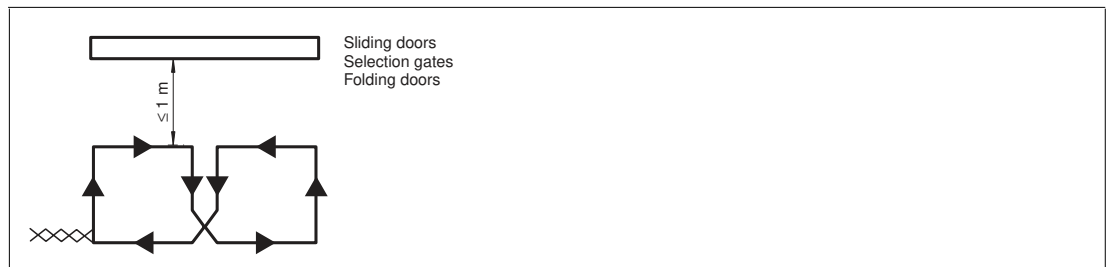
Detection of trucks



Detection of two-wheeled vehicles (motorcycle, bicycle)



Loops with reduced side sensitivity

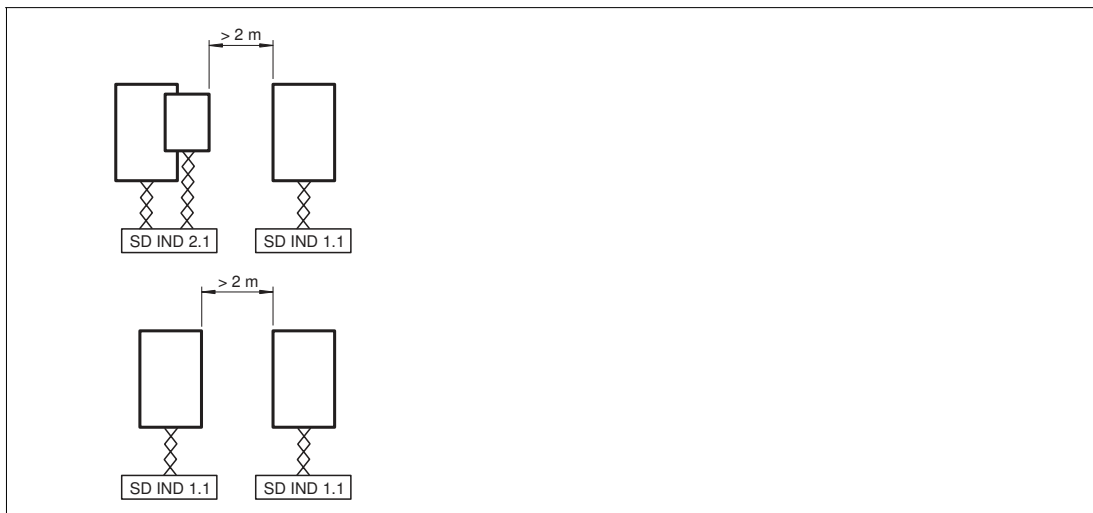


5.3 Loop interference

Interference from adjacent loops

Loops connected to different loop detectors must have a minimum distance of 2 meters from each other and operate on different frequencies.

For loops connected to a double detector this minimum distance can be reduced. However, it must be ensured that the two loops do not operate on the same frequency.



Interference from metal

Fixed metal constructions e.g. steel girders, drains, steel reinforcements are integrated in the automatic compensation of the loop detector and do not affect the safe functioning except for a reduced sensitivity.

Moveable metal constructions e.g. rolling doors and revolving doors must have a sufficiently large distance to the loop (> 1 meter) to prevent triggering the loop detector when moving.

5.4

Influencing variables

Loop inductivity

The recommended number of windings is only dimensioned for a loop inductivity of approx. 200 μH . At this loop inductivity no significant reduction of sensitivity results from a connection lead of up to 50 meters. For longer connection leads (up to max. 150 m) the loop inductivity should be increased by increasing the number of windings.

Loop resistance

The total resistance of loop connection leads and contact resistances should not exceed 5 Ω . The cross section of the loop connection lead should be 1.5 mm^2 .

Steel reinforcements

Steel reinforcements in the floor reduce the loop sensitivity. With heavy reinforcements the loop size should be adjusted optimally to the vehicle size (no large loops) in order to keep the loss of sensitivity low.

Laying loops

The loops must be permanently laid in the floor to prevent malfunctioning due to mechanical movement. Especially when laying between rail tracks a firm installation and the use of a stable complete loop should be ensured.

Connecting loops in series

Connecting loops in series (e.g. opening loops on the inside and outside of gates) considerably reduces the sensitivity (approx. 30 - 50 %). In such cases we recommend the use of the two-channel loop detector LC10-2.

Insulation resistance

Insufficient insulation resistance of the loop to earth, to adjacent loops or of the windings to each other can cause malfunctioning. When laying loops it must be ensured that the line insulation is not damaged by sharp edges in the floor groove.

1 Troubleshooting

Before requesting a service call, please check that the following actions have been taken:

- Equipment has been tested according to the following checklists.
- Telephone assistance has been obtained from the Service Center in order to isolate the problem.

Interference

- The settings of the DIP switches (ON/OFF) were reviewed according to the instruction manual.
- The relay is connected straight and tightly to the plug-in socket.
- All 11 connecting cables were screwed properly and stable to the corresponding plug-in socket.
- All 11 connection terminals are clean and free from any dirt.
- The inductive loop(s) were installed properly. (see laying instructions for inductive loops)

Fault Analysis

Source of Fault	Cause	Action
By using a two-channel loop detector both channels are responding identically.	Both detectors are working on the same frequency.	Different inductive loops (in length and number of loops) must be installed and connected.
The loop detector doesn't react or has contact issues.	The connections are dirty.	Please clean the connection terminals with a suitable contact cleaner. (e.g. Contact Chemistry 60)
The loop detector doesn't react to high vehicles.	Insufficient sensitivity.	The switching threshold must be increased via the DIP switch (sensitivity boost).
The loop detector is triggered without any passing vehicle.	The distance between inductive loop(s) and moveable metallic parts (e.g. gates) is too small.	The distance between the edge of the inductive loop(s) and moveable metallic parts must be at least 1 metre.

FACTORY AUTOMATION – SENSING YOUR NEEDS



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