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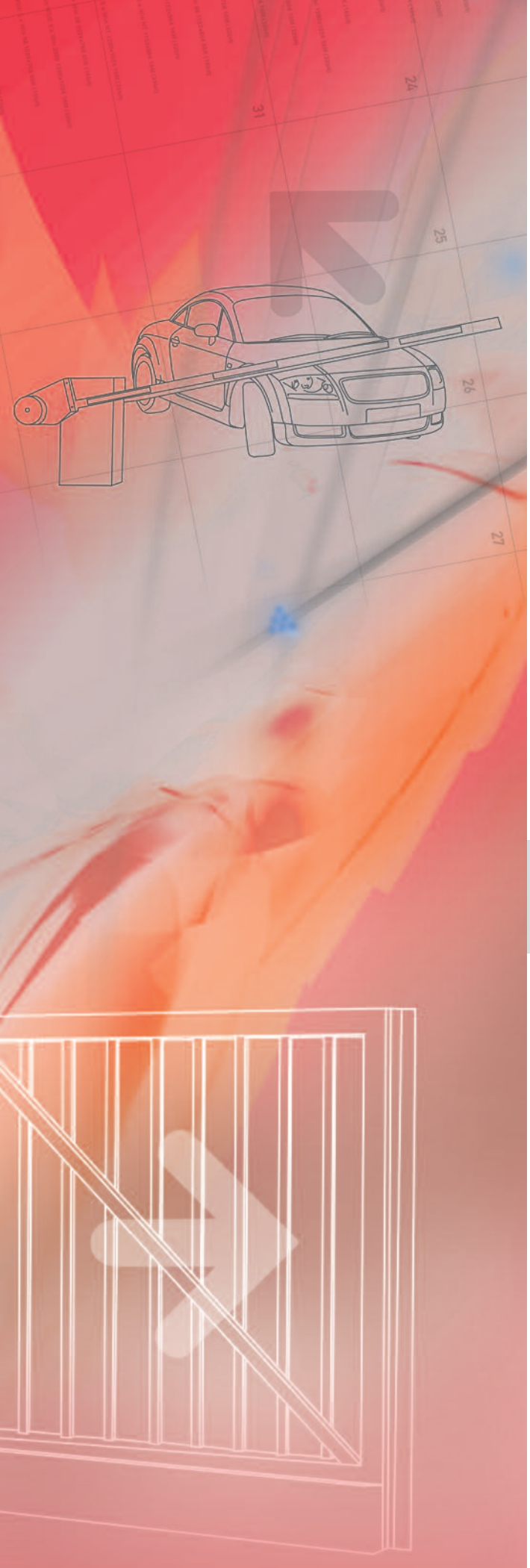
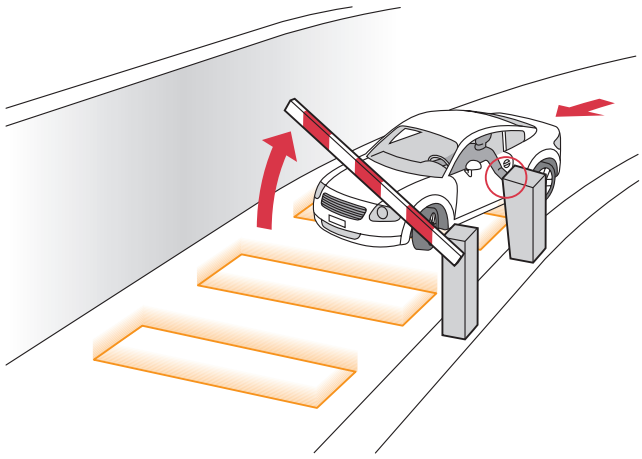


Loop Installation

Manual



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1 General

Loop detectors are frequently used to detect all kinds of vehicles.
The system consists of a detector (switching unit) and an induction loop.

Typical applications include:

- Opening and closing gates
- Controlling barriers
- Monitoring individual parking spaces
- Protecting bollards

2 Operating mode

The induction loop and a capacitor which is integrated in the loop detector form an LC oscillator.
The frequency of resonance of this resonant circuit is determined by the capacity of the capacitor and the magnitude of the loop inductance.
The capacity of the capacitor and thus the resonance frequency can be modified using a parameter setting of the loop detector. This prevents interference between two adjacent induction loops or detectors, for instance.

The lower the loop inductance, the higher the oscillator frequency, which is in the range of 20 to 150 kHz.

A current is passed through the unoccupied (= de-energised) loop, forming a magnetic field around the loop.
The magnetic field lines close along the shortest path to form loops. The oscillator resonates at the basic frequency Fo.

A vehicle driving across the loop enters the magnetic field. The magnetic field lines are deflected and can no longer close along the shortest path to form loops. This reduces the inductance and the oscillator frequency increases.
The loop is "energised". The loop detector detects this change. If the frequency-deviation exceeds the set sensitivity, output is switched. The loop detector has detected the object.

Please observe the detailed information in the loop detector operating instructions.

Loop

Loop detector with DIN snap-on mounting rail

Loop detector with 11-pin base

3 Safety Notes

⚠
- With the use of loop(s) and a loop detector, the operator is responsible for the correct and safe operation of his system.
- For a correct and safe functioning of the system, the type of vehicles to be detected when passing the loop must be considered.
- Please note that a detection of persons and objects with a low proportion of metal parts may not be possible.
- The correct installation of the loop into the road surface is included in the scope of responsibility of the loop installer.
- When producting the groove for the loop, please consider any safety notes for your tools that are included in the operations manual of your tool supplier.
- Damages to the insulation of your loop wire or of the feed line must be avoided in all cases as otherwise the correct functioning of your system is not guaranteed.

4 Induction loop

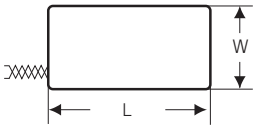
4.1 Loop size and number of turns

In most cases of application the loop is installed in a square or rectangular shape. Depending on the perimeter of the loop (subject to local conditions) a different number of turns must be installed in the loop groove. Therefore, the following rule applies: the smaller the perimeter P of the loop, the more turns are required for the loop.

Recommendations:

- the minimum width of the loop must not be smaller than 0.8 m. View the table opposite.
- Lenght-to-Width ratio: 1:1 up to max. 4:1

Loop perimeter P	Number of turns
3 – 6 m	5 turns
6 – 10 m	4 turns
10 – 20 m	3 turns
20 – 25 m	2 turns



4.2 Inductivity of the loop

The **induction of a loop** can be measured with the the help of a loop detector with an integrated measuring function (e.g. ProLoop) or by means of an appropriate measuring device. Before sealing the loop groove, it is recommended to provisionally install the loop lineas and to measure the inductivity. With the help of the formula below, a rough estimation of the inductivity may be determined in advance:

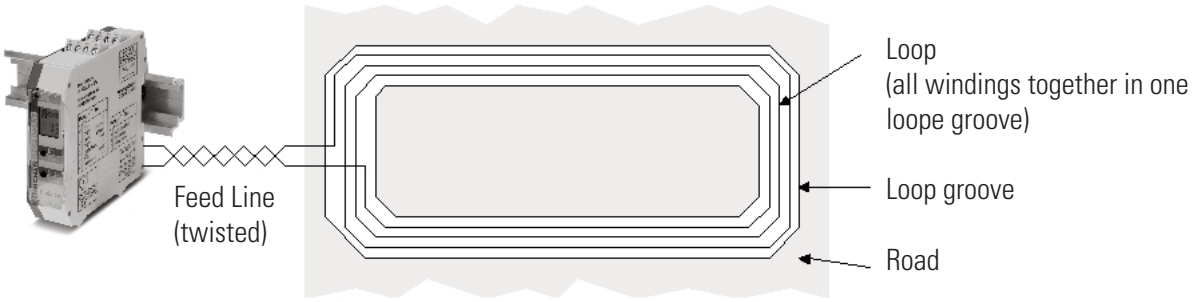
P = perimeter of the loop in m

N = number of turns in the loop

$L\ (\text{in } \mu H) \approx P * (N*N + N)$

An inductivity of approx. 1 - 1.5 H per m of feed line must be added to the calculated value.
The optimum values of the inductivity of a loop lie between 80 – 300 µH.

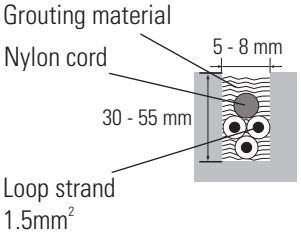
5 Loop installation



5.1 Influence of local conditions, dimensioning of the loop groove and advice for the loop groove

Local conditions	Recommendations
Concrete reinforcement	minimum 5 cm space (as large as possible)
Other electrical lines	shielded feed line towards the loop
Movable metal objects	keep a distance of minimum 1m
Non-movable metal objects	keep a distance of minimum 0.5 m
High-voltage lines and power lines	shielded electrical feed line towards the loop seperated channel
Large distances to the loop detector	shielded electrical feed line towards the loop

Loop groove dimensioning and installation advice:



Grouting material: Cold-type and hot-type bitumen as well as artificial resin is suitable as grouting material.

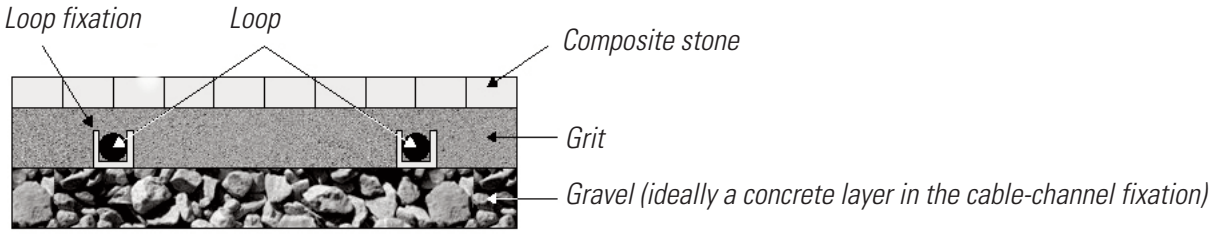
Loop strand: With the use of hot-type bitumen the temperature resistance of the insulation of the loop strand (temperature resistance according to specifications of the loop strand manufacturer) must be considered.

Nylon cord: A nylon cord is only required, if hot-type bitumen is used as grouting material. The cord serves for temperature decoupling towards the loop wire.

5.2 Laying loops under composite stone pavers

The loops are laid in the sand layer between the bottom layer of gravel and the composite stone pavers.

Prefabricated loops must be used for this laying system. They must be installed in an electric-cable channel (15 x 15 mm).



- Insert and fix loop
- Measure electrical resistance and insulation resistance
- Measure inductance, test with loop detector
- Fill with permanently elastic sealing compound
- Fill and seal sand bed
- Lay composite stone pavers and tamp to secure
- Check function

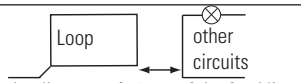
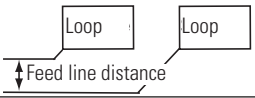
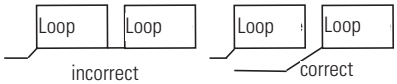
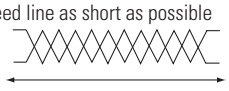
Channeling cobblestones is not recommended. Cobbles may shift under the weight of vehicles, which can cause tractive or shearing forces and damage the loop wires -> malfunctions.

Important
The loop must be laid in such a way that the individual windings cannot shift and touch one another
→ Shifts can lead to changes in inductance → malfunctions.

The loop must be laid in such a way that the overall loop geometry cannot change
→ Geometry changes can lead to changes in inductance → malfunctions.

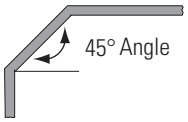
5.3 Feed Line

It is recommended that the feed line of the loop is constructed as a shielded line. The shielding must always be earthed one-sided. Howerver, the loop itself must not be shielded!

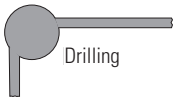
Twist wires of the feed line	The feed line must be twisted at least 20x per meter and laid in a twisted condition up to the connection of the loop detector in the switching cabinet.	 Min. 20 times per meter
Laying of the feed line parallel to other circuits	Laying the feedline in the same cable trunking with other circuits is not allowed.	 Loop other circuits min. distance of 10 cm of the feed line
Loop feed line of other loop detectors	If two 1-loop detectors are applied, keep appropriate distances when laying the feed lines. Use shielded feed lines.	 Loop Loop Feed line distance
Avoid mechanical damage to the feed line	The feed lines must be well protected against mechanical damage.	
Laying the feed line towards the loop detector	Do not lay the feed line through the loop groove of another loop. Use shielded feed lines.	 Loop Loop Loop Loop incorrect correct
Length of the feed line	Keep the length of the feed line as short as possible (recommended maximum length 50 m)	 feed line as short as possible

5.4 Introduction of the Loop Groove, Procedure

1. The groove is cut into the road surface in accordance to the intended dimension of the loop
2. At each corner a mitred groove (angle of 45°) or a drilled hole must be incorporated
3. The groove must then be cleaned (avoid humidity)
4. Insert the loop wire
5. Verify the inductivity/test with loop detector
6. Then the groove must be closed accurately with hot-type or cold-type grouting material (The temperature resistance of the cable sheathing must be considered if hot-type grouting material is used, use adequate temperature-resistant cable). The following aspects must be considered for installation:



Loop groove routing around corners



- no cracks must be present in the road, the road surface must be continuously solid
- avoid damaging the insulation of the loop wire when laying the loop
- special care must be taken when laying the loop over edges
- the loop wire must not protrude from the groove at any point
- before grouting, place a nylon cord onto the wire package and grout subsequently
  The grouting must be water-tight - no humidity must enter the loop groove
- after grouting and before complete hardening of the grouting material, the loop wire must not be moved
- after hardening, measure insulation resistance against earth (>10MOhm @ 250V testing voltage)

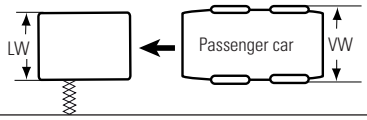
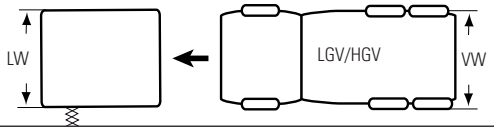
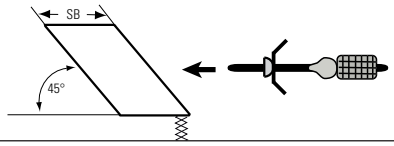
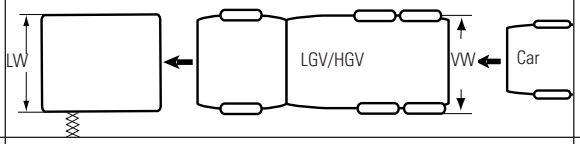
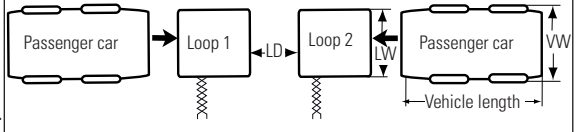
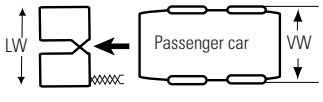
5.5 Loop geometries

⚠ As a basic criterion for loop dimensioning the safe functioning of the system as a whole must be considered. Therefore, the loop must always be constructed for the largest vehicle to be detected. Loop systems are only triggered by metal.

The geometry of a loop (dimension of a loop) should be adapted to individual requirements. To this end, a differentiation must be made for the geometry of the loop between detection of passenger cars, LGV/HGVs, two-wheeled vehicles, mixed application (for passenger cars and utility vehicles) and directional logic. As a result, the dimension of the loop is determined by the vehicles to be detected and by local conditions.

Table of the most commonly used loop geometries:

VW = vehicle width, LW = Loop width. In this context «LW < ≈ VW» means that loop width is smaller or equal to vehicle width VW, LD = Loop distance

Loop geometry for passenger cars		For optimum detection the loop width should be selected to be equal to or smaller than the widest passenger car that is to pass the loop. For this purpose the loop width must be LW < ≈ VW.
Loop geometry for LGV/HGVs		For an optimum detection the loop width should be selected to be equal to or smaller than the widest LGV/HGV that is to pass the loop.
Loop geometry for two-wheeled vehicles		To assure an optimal detection of two-wheeled vehicles, the loop should be positioned as trapezium or parallelogram. She must not be installed to low.
Loop geometry for passenger cars and utility vehicles / lorries		For this purpose the loop width must be constructed such that LGV/HGVs can also be detected safely and correctly. Therefore, the loop must be installed such that the widest lorry to be detected is captured (LW < ≈ VW).
Loop geometry for detection of the direction of travel from loop 1 to loop 2 or from loop 2 to loop 1.		With the help of a 2-channel-loop detector the direction detection function can be activated. Both loops must be constructed according to the rule LW < ≈ VW. In addition, the distance LD must be maintained: LD = max. 0.5 * length of vehicle.
Loop geometry for restricted space conditions		With restricted space conditions (in proximity of a metal object, e.g. a gate) it is recommended to install the loop in the shape of an 8. LW ≈ 1m

6 Problematic Issues in Loop Installation

6.1 Attenuation

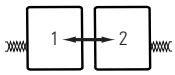
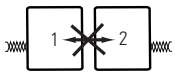
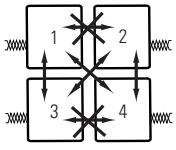
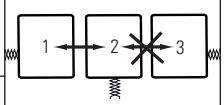
For a correct functioning of a loop system, the attenuation of the loop through the vehicle to be detected is the decisive factor. Attenuation from other sources, such as metal objects, adjacent loop systems, etc. may influence this function. Therefore, such adverse influences must already be considered during the planning phase and be reduced to a minimum.

Undesired attenuation:	**Remidial action / relief:**
Iron reinforcement in concrete road pavement	A sufficient distance to the loop must be maintained (see 5.1 of these instructions).
Fluctuations in temperature	No influence with the application of the ProLoop detector.
Electrical lines in the proximity	A sufficient distance to the loop must be maintained (see 5.1 of these instructions).
Electrical systems	A sufficient distance to the loop must be maintained (see 5.1 of these instructions).
Other loop systems	Application of different oscillating frequencies for the individual loop detectors (see 6.2 Cross-talk), maintain sufficient distance to other loops(see 5.1 of these instructions), use 2-channel-loop-detector for 2 different loop systems.
Metal gates, barriers, poles	A sufficient distance to the loop must be maintained (see 5.1 of these instructions).

6.2 Cross-Talk (mutual influencing of individual loop systems)

It is often the case, that several loop systems are installed next to one another. This causes the issue of cross-talk being generated from one loop system to the next. However, this problem can be prevented through the selection of different oscillating frequencies of the individual loop systems. This may be obtained by setting different oscillating frequencies with the help of a suitable loop detector or by installing loops with different numbers of turns.

(Key: ⟷ = influence ✕ = no influence)

Loop detector	**Loop**	**Loop arrangement**	**Problem**	**Remedial action / relief**	**Effect**
1-channel-loop-detector	1		The oscillating frequency is set for the same frequency for both loop detectors. An influence is possible.	– leave the frequency of loop detector 1 on the frequency setand change the frequency of loop detector 2 to another frequency. – install the two loops with different numbers of turns.	Due to the different oscillating frequencies of the two 1-channel loop detectors cross-talk is no longer possible.
1-channel-loop-detector	2				
2-channel-loop-detector	1 2		–		Through the application of a suitable 2-channel-loop-detector cross-talk is prevented.
2-channel-loop-detector	1 and 2		The oscillating frequency is set for the same frequency for both 2-channel loop detectors. Cross-talk is possible.	– leave the frequency of the 2-channel loop detector 1 on the frequency set and change the frequency of the 2-channel loop detector 2 to another frequency. – install the two loops with different numbers of turns.	Due to the different oscillating frequencies of the two 2-channel-loop-detectors cross-talk is no longer possible.
2-channel-loop-detector	3 and 4				
1-channel-loop-detector	1		The oscillating frequency is set to the same frequency values for the 2-channel-loop-detector and the 1-channel-loop-detector. Cross-talk is possible.	– leave the frequency of the 1-channel-loop-detector 1 on the frequency set and set the frequency of the 2-channel-loop- detector 2 to another frequency – install the two loops with different numbers of turns.	Due to the different oscillating frequencies of the 1-channel loop-detector and the 2-channel loop-detector cross-talk is no longer possible.
2-channel-loop-detector	2 and 3				

7 Detection of functional disorders and trouble-shooting

Defect / malfunction	possible cause	Trouble / remedial action
1: Some vehicles are not detected (e.g. passenger cars - yes; LGV/HGVs - no)	– the sensitivity of the loop detector has been set too low. – loop geometry selected incorrectly (e.g. too few loop turns) – existing cross-talk from another loop system – the feed line of the loop has been rolled up instead of shortening it to the appropriate length – other metal objects cause a permanent attenuation	– increase the reactive sensitivity at the loop detector – check the lay-out of the loop – shorten the loop feed line to an appropriate length and consider correct twisting – set the loop frequencies of adjacent loop systems to different frequency values
2: Trailer drawbar is not detected	– automatic increase of detection sensitivity is not switched on at a suitable loop detector	– switch on the automatic detection sensitivity at a suitable loop detector
3: Detection is not taking place, although the loop detector is fed with supply woltage.	– loop dimension is too large – loop dimension is too small – the loop detector is not fed with enough energy – the loop has a short-circuit – the loop has an interruption	– measure the inductivity by means of a suitable loop detector and dimension the number of turns of the loop according to the value (ideally 80–300 µH) stated of the loop detector. – Verify the auxiliary energy and set to the required value of the loop detector. – measure the loop resistance with the help of an ohm-meter and with the occurrence of a short-circuit newly lay the loop. – with any occurrence of an interruption, inspect the connection of the feed line, re-lay the loop.
4: System reacts to vehicles that are not intended to be detected.	– detection sensitivity of the loop system set too high	– test the functionality of the system by means of various vehicles. To this end, also use vehicles that are not intended to be detected. Subsequently set the detection sensitivity such that vehicles intended for detection are actually detected, but not other vehicles.
5: The loop detector signals a detection, although no vehicle has passed/is standing on the loop.	– cross-talk from another loop system is taking place – the loop has not been installed correctly (feed line has not been twisted, the used feed line is not shielded, other metal objects are positioned too close, the loop wire can move within the loop groove, other electrical sources of disturbance are in the proximity) – the isolation of the loop is damaged or the loop restistance is to high. See item **7**	– all loop systems in the proximity must be set to different oscillating frequencies. – Inspect the lay-out of the loop wire and prevent any movement through appropriate measures (e.g. through sand filling) – inspect twisting of the feed line – Install the loop in an adequate (large) distance to other metal objects. – also maintain appropriata (large) distance to electrical sources of disturbance, eg. radio-entrance-systems – use shielded feed lines.
6: The loop detector permanently detects an occupation of the loop but no vehicles are present on the loop.	– the loop or its feed line is damaged (short-circuit or interruption).	– see item **3**
7: In rainy weather there are occasional malfunctions.	– the insulation of the loop wire is damaged – the connection between loop and feed line has not been carried out water-tight.	– measure the insulation resistance, if it is not larger than 1 M Ohm the insulation is damaged, the loop wire or the feed line must be replaced. – lay the loop and its feed line and install the connection water-tight.
8: Detection of the direction of travel does not function.	– the distance of the two loops to each other is too large. – incorrect function set at the loop detector.	– the distance of two loops to each other must be selected such that for a short time both loops are occupied, therefore – set the correct function at the loop detector
9: **The loop system cannot be adjusted.**	– the loop has an incorrect loop inductivity (value does not lie within the permissible operational range for the loop detector) – the loop has a damage – the loop detector is defective	– Adapt the number of turns of the loop according to the loop geometry (see 4.1) – inspect the loop for damages – replace the loop detector