LC20-2
Dual Channel Loop Detector
User Manual

Dokument Nummer: TDOCT-6470_ENG
Ausgabedatum: April 2019

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Contents

WARNING: 1. This unit must be grounded (earthed) !

WARNING: 2. Disconnect power before working on this unit !

WARNING: 3. Installation and operation by service personnel only !

WARNING: 4. No user serviceable parts inside. No internal settings. Warranty void if cover removed !

WARNING: 5. Always suspend traffic through the barrier area during installation and testing that may result in unexpected operation of the barrier.

WARNING: 6. USA

FCC Advisory Statement – Refer to Appendix A at the end of this document.

WARNING: 7. Europe

Disposing of the product:

This electronic product is subject to the EU Directive 2012/19/EU **for Waste Electrical and Electronic Equipment (WEEE). As such, this product must not be disposed of at a local municipal waste collection point. Please refer to local regulations for directions on how to dispose of this product in an environmental friendly manner.**

1. Introduction

The LC20-2 Series Dual Channel Inductive Loop Vehicle Detector is a dual channel microprocessor based detector designed specifically for parking and vehicle access control applications. It is suited primarily for complex multilane access control and counting applications. Using the most up-to-date technology, the LC20-2 has been designed to meet the requirements of a vast number of parking applications pertaining to operating conditions and various options available to the user.

The primary function of the detector is to detect vehicle presence by means of an inductance change caused by the vehicle passing over a wire loop buried under the road surface.

Figure 1. The LC20-2 Loop Detector (11 Pin housing on left and DIN Rail on right)

The detector has been designed for ease of installation and convenience, with automatic frequency selection to assist with installation, it is easily configured to suit various applications.

By making use of the DIP switches and push button, the LC20-2 can be easily set up for the users application needs. The unit also provides diagnostics by means of the LC20-DT unit.

The LC20-2 provides visual outputs (LED's) on the front of the enclosure to provide an indication of the state of the channels as well as the detector itself. The channel LEDs indicate whether a vehicle is present over the loop or there is a fault on the loop while the power LED indicates that the unit has been powered, is operational and provides a means of communication via the LC20-DT units.

The unit has relay change-over contacts at the rear of the enclosure for providing outputs as configured by the front panel DIP switches.

Although it is a dual channel detector, the design eliminates the possibility of crosstalk between the loops connected to the detector by using sequential channel scanning.

Related Documents are listed below

Installation Leaflet	Document No. TDOCT-6306_ENG

2. Technical Data

2.1 Functional data

Tuning	Fully Automatic with option to enable Automatic Frequency Selection (AFS)
Self-tuning range	20 µH to 1500 µH
Sensitivity	Four steps adjustable on the DIP switches (High, Medium-High, Medium-Low, Low) Options available are 0.01% ΔL/L, 0.02% ΔL/L, 0.05% ΔL/L and 0.10% ΔL/L ASB (Automatic Sensitivity Boost) is selectable via the DIP switches
Frequency	With AFS switched on the channel tunes automatically to one of five possible frequencies There are four selectable frequency options with AFS switched off Operating frequency of 18 – 110 kHz (Determined by loop geometry and frequency setting)
Output Configuration	2 output relays User configurable for: Presence on detect Pulse on detect
Pulse Output Duration	150ms
Presence Method	Permanent or Limited presence
Presence Time	Infinite when the unit is on Permanent Presence Dependant on level of detect and environmental conditions when on Limited Presence
Drift Compensation Rate	Approx. 1 %ΔL/L per minute
Response Times	Detect: 53.0 – 73.0ms Undetect: 280.0 – 350.0ms Subject to sensitivity level, level of detect and speed of vehicle over the loop
Visual Indications	1 x Power / Status LED – Red 2 x Channel Status LED – Green
Reset	Holding the reset button for 3s initiates a retune
Surge protection	Loop isolation transformer, gas discharge tubes, and Zener diode clamping on loop input.
Power Fail	Infinite memory retention of detector state on power failure (provided certain criteria are met refer to section 4.5). This function can be turned on and off via the Reset push button.

2.2 Electrical Data

Power requirements 230V AC ± 10% (48 to 62Hz) (LC20-2-RB/DR 230VAC)
Requirement: 2.6 VA Maximum @ 230V

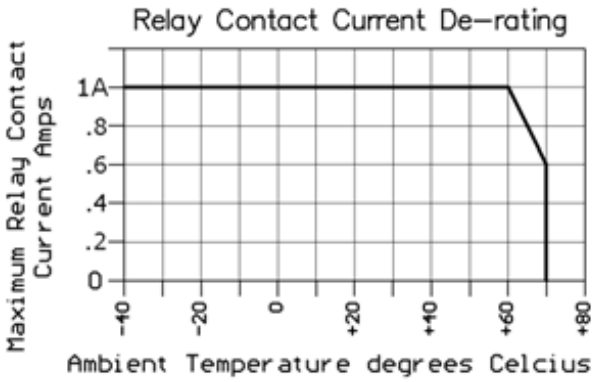
12-24V ± 10% DC/AC (48 to 62Hz) (LC20-2-RB/DR 12-24VAC/DC)

Requirement: 1 VA Maximum @ 12 V

Relay Contact Rating Relay contact rating: 2A@30VDC, 0.5A@125VAC, 0.25A@250VAC

For ambient temperatures above 60°C De-rate the relay

Maximum current as per graph below:



2.3 Environmental Data

Storage Temperature -40°C to +70°C

Operating Temperature -40°C to +70°

Humidity Up to 95% relative humidity without condensation

Circuit protection Conformal coating over the PCB and all components

IP Rating IP30 – This product MUST be installed in an enclosure

2.4 Mechanical Data

Housing Material ABS blend

Mounting Position DIN rail mounting and Shelf

Connections 11-pin Submagnal (JEDEC No. B11-88) OR

2x 6 way Plugs on DIN Rail Mount

The figure below shows the 11 pin connector on the rear of the LC20-2 unit, as well as the DIN Rail clip for the DIN Rail housing version. The 11 pin connector plugs into a relay base that accommodates all of the wiring for the unit. A list of acceptable relay bases is given below. The DIN Rail housing plugs directly onto the DIN Rail and is fitted with 2x 6 way connectors for wiring the necessary connections.

Figure 2. LC20-2 rear view showing the 11 pin connector on the left and the DIN Rail housing on the right

Relay base recommendations:

Manufacturer	Part Number
Finder	90.23
Bremas Ersce	ES 12
TE connectivity (Schrack)	MT78740
Schneider Electric	RUZC3M
Ormron	PF113A-D
Allen Bradley	700-HN101

Size of Housing 78mm (High) X 41mm (Wide) X 80mm (Deep)

2.5 Approvals

EMC	EN 61000-6-3 EN 61000-6-2 EN 60255-27
LVD	EN 60204-1
RoHS	EN 50581
RE	ETSI EN 301 489-1 ETSI EN 301 489-3

3. Operating Procedure

3.1 Hardware setup

The LC20-2 Series dual channel loop detector is designed to be DIN rail mounted, with the controls and visual indicators at the front, and wiring at the rear of the enclosure. The power, loop and relay outputs are connected to the 11 pin relay base at back of the housing.

3.2 DIP Switch Selections

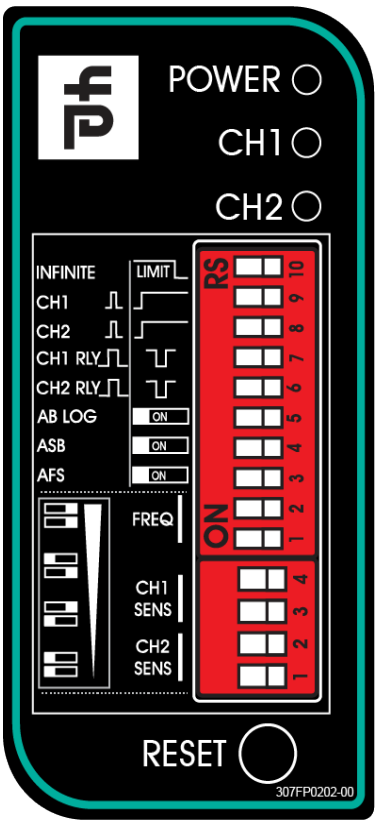


Figure 3. LC20-2 Faceplate

3.2.1 Presence (switch 10)

The presence setting determines how the detector tracks a detect. There are two modes, permanent presence and limited presence.

Permanent presence mode is aimed at maintaining the presence of a vehicle over the loop by continuously compensating for all environmental changes. This is used in situations where safety is involved and the detector is required to maintain the detect until the vehicle leaves the loop.

Limited presence is aimed at limiting the presence of a vehicle over the loop. This is used in situations where statistics or control is involved and a vehicle parked over the loop should not prevent continued operation. The presence time is related to the size of the detect. Typically a 1% ΔL/L will timeout after approximately 1 hour.

3.2.2 Pulse on detect / Presence on detect (switch 9 and 8)

When a vehicle enters the loop the relay can either give a 150ms pulse on detect, or give an output for the entire time that the vehicle is detected by the detector. This setting can be made for each channel respectively as indicated on the faceplate.

3.2.3 Fail-safe or Fail-secure (switch 7 and 6)

The relay output polarity of the presence relay can be switched between fail-safe and fail-secure via the DIP switches.

In fail-safe, the output is the same in detect as it is with no power applied to the unit. Related to an access control situation, this is used in situations where the loss of power must not lock people out. Either a valid detect situation, or a power failure/ fault will provide a signal.

In fail-secure, the output is the same in un-detect as it is with no power applied to the unit. Related to an access control situation, this is used in situations where the loss of power must not allow free entry. Only a valid detect situation will provide a signal.

3.2.4 AB Logic (switch 5)

AB logic can be used to count the cars going in a specified direction. A transition from loop 1 to loop 2 (classified as forwards) results in a 150ms pulse output on Relay 1. A transition from loop 2 to loop 1 (classified as backwards) results in a 150ms pulse output on Relay 2. This function can easily be switched off by making use of the DIP switches as indicated on the tables.

3.2.5 Automatic Sensitivity Boost (ASB) (switch 4)

ASB is a mode which alters the un-detect level of the detector, and can be toggled on or off via the DIP switches. ASB causes the sensitivity level to be boosted to a maximum on detection of a vehicle, irrespective of current sensitivity level and maintained at this level during the entire presence of the vehicle over the loop. When the vehicle leaves the loop and the detection is lost, the sensitivity level reverts to the pre-selected level. This is typically used for vehicles with high beds, or vehicles towing trailers, where it is important to not lose the detect over the entire length of the vehicle.

3.2.6 Automatic Frequency Selection (AFS) (switch 3)

This setting allows the detector to briefly evaluate all five frequency bands and select the best operating frequency available. The tuning time with AFS switched on can range between 5 to 20 seconds. With AFS switched off, the frequency can be selected manually.

3.2.7 Frequency (switch 2 and 1)

The frequency switches are used to shift the operating frequency of the detector. This is primarily used to handle situations in which more than one detector is used at the same site. The detectors must be set-up to ensure no crosstalk (interference) occurs between adjacent loops connected to different detectors. This is achieved by ensuring that the loops of the two detectors are spaced sufficiently apart (approximately 2 metres between adjacent edges) and also ensuring that the detectors are set to different frequencies.
The loops connected to multichannel detectors are not susceptible to crosstalk due to the design of the loop interface.

Sw2	Sw1	Frequency
Right	Right	High Frequency
Left	Right	Medium High Frequency
Right	Left	Medium Low Frequency
Left	Left	Low Frequency

3.2.8 Sensitivity (switches 1 to 4)

The sensitivity of the detector determines the change of inductance necessary to produce a detect. The LC20-2 provides a selectable range of four sensitivity settings. Sensitivity is defined as a change in the inductance, with the LC20-2 it ranges from 0.01% to 0.1%, with 0.01% being the highest sensitivity selection.

Sw4	Sw3	Sensitivity Channel 1
Right	Right	(0.01%) - High Sensitivity
Left	Right	(0.02%) - Medium High Sensitivity
Right	Left	(0.05%) - Medium Low Sensitivity
Left	Left	(0.10%) - Low Sensitivity

Sw2	Sw1	Sensitivity Channel 2
Right	Right	(0.01%) - High Sensitivity
Left	Right	(0.02%) - Medium High Sensitivity
Right	Left	(0.05%) - Medium Low Sensitivity
Left	Left	(0.10%) - Low Sensitivity

3.2.9 Push button (Retune and Powerfail)

The push button can be used to initiate a retune or to switch Powerfail on or off depending on how long the push button is held in.

Switch	Description	Hold	Function
Push button	Reset	3 sec	This would initiate a detector retune
	Power fail status	10 sec	Hold for 10s to determine the state of Powerfail. If the LEDs are ON, Powerfail is ON. If the LEDs are OFF, Powerfail is OFF.
	Power fail toggle	30 sec	Holding for 30s will toggle the Powerfail status. The state of Powerfail is known after holding for 10s. After 30s, if the LEDs turn OFF, Powerfail is now OFF. If after 30s the LEDs turn ON, Powerfail is now ON.

The LC20-2 has a Powerfail function which is designed to retain the memory of a vehicle on the loop in the event of a power fail situation. This is designed specifically for fail safe situations to retain the output state and prevent a glitch on the outputs in the event of a power failure.

3.3 Front Panel Indicators

The front panel indicators consist of a Red Power / Communication LED and one Green Channel LED.

There are four possible conditions which are indicated by the LED's.

- Idle condition – no vehicle is detected
- Detect condition – a vehicle is detected passing over the inductive loop
- Tuning condition – the detector is currently tuning to the loop
- Fault condition – the detector is unable to tune to the loop as it is either out of operational conditions such as low signal strength or frequency out of range, or there exists a fault on the loop such as a short circuit or an open circuit.

If a loop fault exists, the Green Channel LED will come on and flash at a rate of 2Hz indicating that the unit is trying to tune. If the fault is self-healing, the detector will continue to operate but the LED will flash at a slower rate of 1Hz indicating to the user that a fault has occurred. The detector must be power cycled or reset via the pushbutton in order to clear the historical fault information.

In the event of a vehicle passing over the inductive loop and causing a detect, the Green Channel LED will light up indicating the presence of a vehicle and remain on for the duration of the detect.

It should be noted that the Channel LED does NOT necessarily represent the output state of the relays. It only represents the detection of a vehicle over the loop. The relay state could, for example, be different from the LED state in the case of a pulse output after its pulse duration or a fault output. The only time the Channel LED will go off while a vehicle is still present is if the channel is in limited presence mode and has expired.

The Red Power LED indicates that the unit is powered and functional. The red LED is also used as a communication interface with the LC20-DT to obtain diagnostics.

4. Operation

The inductive loop detector senses the presence of a vehicle over an area defined by a loop of two or more turns of wire, laid under the road or pavement surface. This loop of wire is connected to the detector by a twisted pair of wires called a loop feeder.

A vehicle passing over a sensing loop causes a small reduction in the inductance of the loop, which is sensed by the detector. The sensitivity of the detector is adjustable to accommodate a wide range of vehicle types, as well as different loop and feeder combinations.

Upon detection of a vehicle passing over the loop the detector operates its output relays, which may be used to indicate controls associated with the installation.

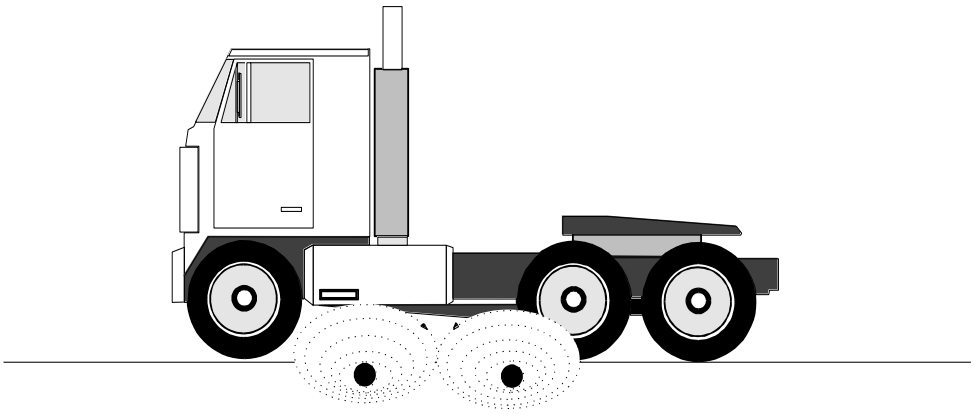


Figure 4. Magnetic field from inductive loop interacting with a vehicle

4.1 Detector Tuning

Tuning of the detector is fully automatic. The detector will re-tune if any of the following events occur:

- When power is applied to the detector and Powerfail is OFF
- A channel reset is initiated via the push button
- A detect of greater than 16% Δ L/L occurs.
- A fault has occurred and is self-healing.

The detector will automatically tune the channel to its connected loop. The detector will tune to any loop with an inductance in the range 20 to 1500 micro-henries (µH). This wide range ensures that all loop sizes and feeder combinations will be accommodated in the tuning range of the detector. Once tuned, any slow environmental change in loop inductance is fed to a compensating circuit within the detector, which keeps the detector correctly tuned.

4.2 Detector sensitivity

Sensitivity of the detection system is dependent on factors such as loop size, number of turns in the loop, feeder length and the presence of metal reinforcing beneath the loop.

The nature of the application determines the required sensitivity, which may be adjusted by means of the Sensitivity DIP switches as indicated on the detector.

Multiple sensitivity levels have been provided in the LC20-2 Series Detector, making it one of the more sensitive detectors available. The detection of small unwanted objects such as bicycles and trolleys may be eliminated by selecting lower sensitivity levels while high-bed vehicles and vehicle/trailer combinations will not lose detection by using Automatic Sensitivity Boost (ASB) option.

ASB operates as follows: When ASB is disabled, the un-detect level is dependent on the sensitivity setting of the detector. Hence as the detector is made less sensitive, the un-detect level will reduce accordingly. When ASB is enabled the un-detect level is fixed irrespective of the sensitivity setting and will be equivalent to the un-detect level when the sensitivity is on maximum setting.

4.3 Types of Outputs

When a relay is configured as a presence output, it will produce a continuous output during the presence of a vehicle over the inductive loop. When configured as a pulse output, the relay will output a pulse on detect according to the pulse duration setting.

For the LC20-2 both relays can be configured to operate as either a presence output relay or a pulse output relay, And for both the user can select them to operate either is fail safe or fail secure mode.

Presence Relay Programming		
	Fail Secure	**Fail Safe**
Relay		
Un detect	Closed	Open
Detect	Open	Closed
Fault	Closed	Closed
Power Off	Closed	Closed

Figure 5. Relay output configuration options

In fail-safe, the output is the same in detect as it is with no power applied to the unit. Either a valid detect situation, or a power failure/ fault will provide a signal. In fail-secure, the output is the same in un-detect as it is with no power applied to the unit. Only a valid detect situation will provide a signal.

4.4 Response times

The response time of the detector is the time taken from when a vehicle moves over the loop to when the detector gives an output.

The response times of the LC20-2 have been adjusted to prevent false operation in electrically noisy environments, but retain adequate response to vehicles in parking and vehicle access control applications.

The response time will be proportional to the level of sensitivity, the level of the detect and the speed of the vehicle. In other words, a fast moving large detect will respond quicker than a slow moving small detect. Also, if the sensitivity is set very low, the point at which it crosses the threshold will be later than higher sensitivity settings. At maximum sensitivity the response time is slower than other sensitivity levels to prevent false operation from noisy environments.

4.5 Powerfail

The LC20-2 is designed with a Powerfail feature that allows it to remember its operating conditions and detect status in the event of power being removed. When power is restored, the unit continues operating from its saved conditions and status. This is designed specifically for fail safe situations to retain the output state and prevent a glitch on the outputs for a power failure. As such, when the power is restored the detector will not retune and will instead return to the detect state prior to the power failure. If a vehicle was on the loop during the power failure, it will remain detected when the power is restored. Thus it prevents the tuning out of a vehicle over the loop during a power failure.

The memory retention of the vehicle is designed to be infinite, but is subject to the following limitations:

The level of the detect must be sufficiently greater (at least 0.8%) than the sensitivity level or else the maximum potential temperature drift from one time of day when the power fails to another when the power returns mustn't exceed 20°C.

The level of the detect should be no less than 0.15% and a minimum of 0.8% above the sensitivity level.

With AFS activated, none of the channels must be in fault since this will cause the unit to retune on recovery.

If the presence of a vehicle should occur less than a second before power is lost, there is a chance that the unit won't retain the detect and the outputs could toggle on restoration of power.

If these conditions are not met, it is possible for the detect condition to be lost on recovery of power.

Powerfail cannot be guaranteed to work if a user interferes with the detector in any way when the power is OFF. No settings are allowed to be changed. The enclosure housing the detector shall NOT be opened when the unit is OFF and Powerfail is turned on, as any drastic change in temperature could result in Powerfail starting up in the incorrect state. Pepperl+Fuchs accepts no responsibility or liability in the event of incorrect behaviour caused by user interference.

4.6 Automatic Frequency Selection

AFS allows the detector to briefly evaluate all five frequency bands and select the best operating frequency available. It weighs up each selection based on where the frequency is located within the operational range, the signal strength, and the level of detected noise. AFS allows the detector to evaluate all the frequency selections.

Due to the increased processing required, AFS takes longer to tune than when it is deactivated. The tune time with AFS on can range from 5 to 20 seconds. If after this period of time, the detector still has not tuned, it is also possible that none of the frequency selections are suitable for the loop. If this occurs, manual frequency selection should be used. Due to the sporadic nature of noise, the channel may seem quiet during the evaluation but still suffer from cross-talk.

AFS can be toggled on or off via the DIP switch. While the detector is tuning, it is recommended to allow the AFS tuning to complete.

On both manual and automatic frequency selection, once a valid frequency offset has been selected, the detector waits for that setting to settle below the sensitivity setting before allowing normal operation to continue. If there is sufficient drift from an extreme temperature change in the installation location or vehicles driving over the loop at the time, it is possible that the tuning will timeout, invalidate that frequency selection and attempt to tune again. If the situation is very close to the limit, it is possible that it might tune as the drift or noise goes back over the threshold and the unit goes into detect just as it tunes. In a noisy environment, this can be prevented by retuning and if the situation persists to decrease the channel sensitivity.

5. Installation guide

Optimum functioning of the detector module is largely dependent on factors associated with the inductive sensor loop connected to it. These factors include choice of material, loop configuration and correct installation practice. A successful inductive loop vehicle detection system can be achieved bearing the following constraints in mind, and strictly following the installation instructions. The detector must be installed in a convenient weather proof location as close as possible to the loop.

5.1 Product Safety Requirements

- **i) WARNING:** The unit must be GROUNDED (earthed)**.**
- **ii) WARNING:** Disconnect the power before working on the unit**.**
- **iii) WARNING:** On the 230 V_{AC} models a readily accessible disconnect device must be incorporated into the mains wiring (as per EN60950-1 Section 1.7.2.2).
- **iv) WARNING:** On all models the power supply to the unit MUST have short circuit protection and over current protection installed at the power supply source (As per EN 60950-1 section 1.7.2.3). Typically this will be a 5 Amp Magnetic Circuit Breaker for AC models and a fuse for DC models.
- **v) WARNING:** This product must be installed in an enclosure as the IP rating of the detector is IP 30.
- **vi) WARNING:** No user serviceable parts inside. No internal settings. Warranty void if cover removed.
- **vii) WARNING:** Only use **CE** approved 11 pin relay bases

5.2 Operational Constraints

5.2.1 Environmental Factors to Consider

Even though the LC20-2 Series parking detectors are housed, the system integrator MUST ensure that the detector is installed in a housing/fire enclosure to protect it from the environment.

The LC20-2 Series parking detectors are rated to operate from -40°C to +70°C but the rate of temperature change MUST not exceed 1°C per minute. This system integrator MUST ensure that the housing used complies with this rate of temperature change requirement.

For installation **Outdoors** refer to Appendix B.

5.2.2 Crosstalk

When two loop configurations are in close proximity, the magnetic fields of one can overlap and disturb the field of another loop. This phenomenon, known as crosstalk, can cause false detects and detector lock-up.

Should the loops be connected to the same dual channel detector crosstalk will not occur, due to the fact that sequential polling of the loops takes place, resulting in only one loop being energised at a given time.

Crosstalk between adjacent loops operating from different detector modules can be eliminated by:

1. Careful choice of operating frequency. The closer together the two loops, the further apart the frequencies of operation must be.
2. Separation between adjacent loops. Where possible a minimum spacing of 2 metres between loops should be adhered to.
3. Careful screening of feeder cables if they are routed together with other electrical cables. The screen must be earthed at the detector end only.
4. Running feeder cables in their own slots, separated by at least 300 mm.

For additional information on **Crosstalk** refer to the section "Crosstalk Prevention" in the LC20-DT Diagnostic Unit User Manual TDOCT-6483_ENG.

For information about resolving **Crosstalk** refer to the "Theory of Application" section in the LC20-DT Diagnostic Unit User Manual TDOCT-6483_ENG.

5.2.3 Reinforcing

The existence of reinforced steel below the road surface has the effect of reducing the inductance, and therefore the sensitivity of the loop detection system. Where reinforcing exists 2 turns should be added to the normal loop, as referred to in section 5.4.

The ideal minimum spacing between the loop and the cable and steel reinforcing is 150mm, although this is not always practically possible. The slot depth should be kept as shallow as possible, taking care that no part of the loop or the feeder remains exposed after the sealing compound has been applied.

5.3 Loop and Feeder Material Specification

Extensive studies have been undertaken over the years by various agencies around the world in order to ascertain the optimum loop installation materials.

As an insulated conductor is a prerequisite, PVC covered cable has been used for many years as a first choice, but tests have shown, in fact, that this is unsuitable for long term installations. The PVC tends to become porous with the result that adjacent loops become electrically coupled to one another, with resultant crosstalk implications. Instability and susceptibility to electrical interference can also result.

The insulation must withstand wear and abrasion from the shifting streets, moisture, attack by solvents and oils, as well as withstand the heat of high temperature sealants.

Silicone insulated cable has emerged as one of the preferred insulation materials. Other insulation materials are rubber, thermoplastic, synthetic polymer and cross linked polyethylene.

Stranded loop wire is preferred over solid wire. Because of its mechanical characteristics, a stranded wire is more likely to survive bending and stretching than a solid wire.

A heavy gauge conductor is definitely desirous in order to maintain the loop Q-factor. The loop and feeder should preferably constitute a single length of insulated multi-stranded copper conductor, with no joints and with the copper having a minimum cross section 1.5 mm^2. The feeder is twisted to minimise the effect of electrical noise.

Joints in the loop or feeder are not recommended. Where this is not possible, joints are to be soldered and terminated in a waterproof junction box. This is extremely important for reliable detector performance. Other forms of joins such as those available in kits, where the joint is properly sealed against moisture, are also permitted.

5.4 Sensing Loop Geometry

NOTE: 1) The circumference of the loop must not exceed 30 m.
2) The area of the loop must not exceed 30 m^2 and must not be less than 1 m^2.
3) The loop must be constructed as detailed below.

Sensing loops should, unless site conditions prohibit, be rectangular in shape and should normally be installed with the longest sides at right angles to the direction of traffic movement. These sides should ideally be 1 metre apart.

Loops operating from the same detector module can share a common slot along one of the longer sides, if so required. This type of configuration could be applied in a direction logic application. The maximum separation permitted for this application is 1 metre, ensuring that a vehicle can straddle both loops simultaneously in the required direction of travel.

The only factor which governs maximum separation between loops in all other applications is the feeder length, with 100 metres being the maximum recommended length.

The length of the loop will be determined by the width of the roadway to be monitored. The loop should reach to within 300 mm of each edge of the roadway.

In general, loops having a circumference measurement in excess of 10 metres should be installed using two turns of wire, while loops of less than 10 metres in circumference should have three turns. Loops having a circumference measurement less than 6 metres should have four turns.

It is good practice at time of installation to construct adjacent loops with alternate three and four turn windings.

5.5 Loop Installation

All permanent loop installations should be installed in the roadway by cutting slots with a masonry cutting disc or similar device. A 45° crosscut should be made across the loop corners to reduce the chance of damage that can be caused to the loop at right angle corners.

NOMINAL SLOT WIDTH: 4 mm
NOMINAL SLOT DEPTH : 30 mm TO 50 mm

A slot must also be cut from the loop circumference at one corner of the loop, leading to the roadway edge to accommodate the feeder.

A continuous loop and feeder is obtained by leaving a tail long enough to reach the detector before inserting the cable into the loop slot. Once the required number of turns of wire are wound into the slot around the loop circumference, the wire is routed again via the feeder slot to the roadway edge.

A similar length is allowed to reach the detector and these two free ends are twisted together to ensure they remain in close proximity to one another (Minimum 20 turns per metre) Maximum recommended feeder length is 100 metres. It should be noted that the loop sensitivity decreases as the feeder length increases, so ideally the feeder cable should be kept as short as possible.

The loops are sealed using a “quick-set” black epoxy compound or hot bitumen mastic to blend with the roadway surface.

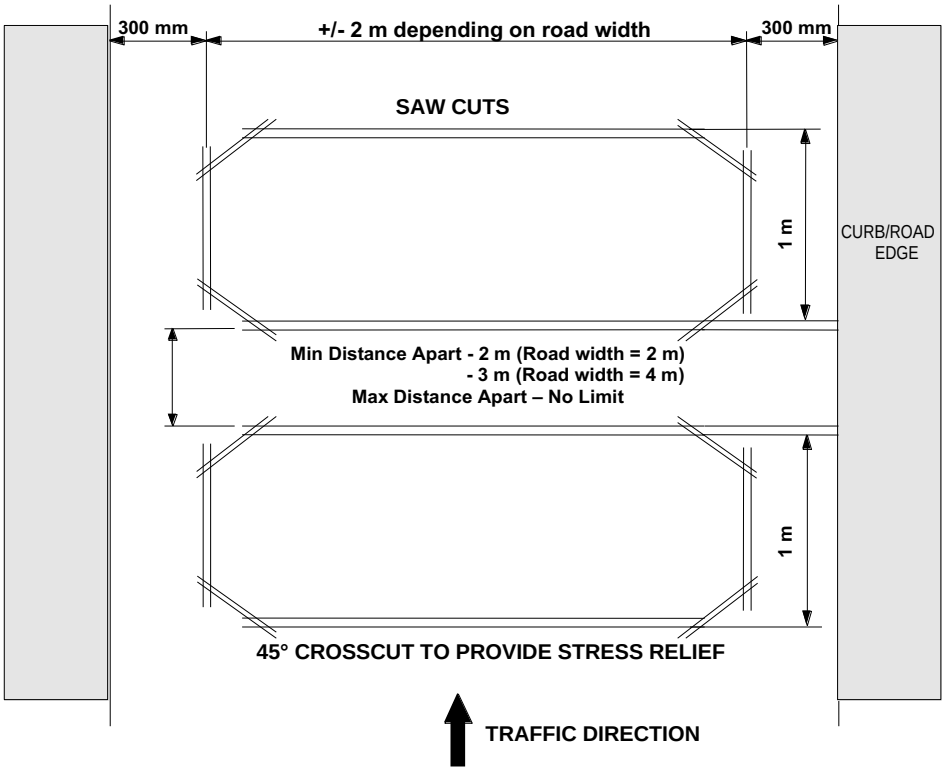


Figure 6. Adjacent loops connected to different detector modules

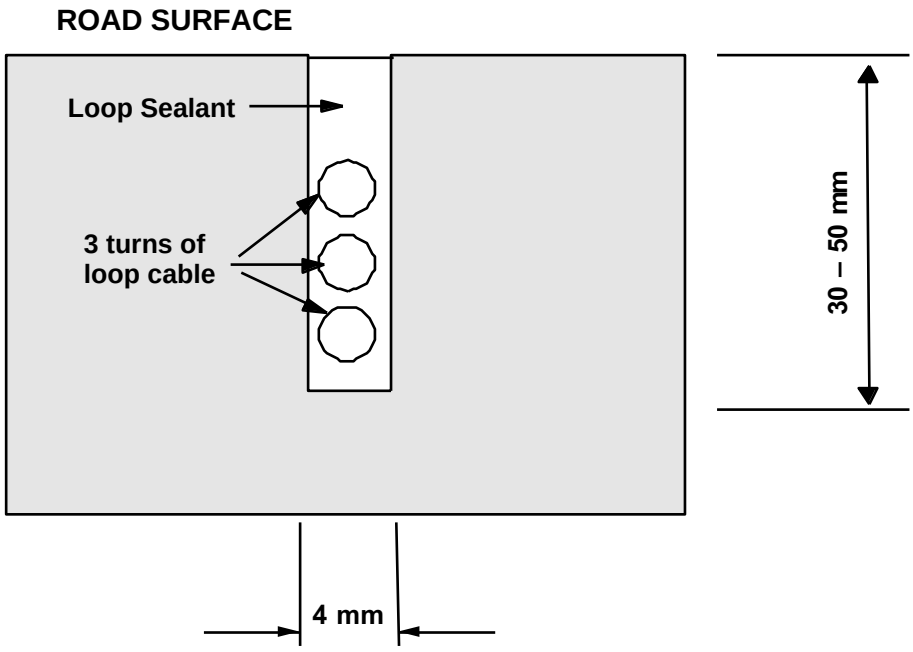


Figure 7. groove

6. Configuration

WARNING: The connector PIN assignments vary from model to model. Refer to the label on the side of the unit for connector PIN assignment.

6.1 LC20-2-RB 230VAC Detektor

11-pin connector wiring

11 POL-Stecker Pol-Nr.	FUNKTION	
1	L	Power supply 230V AC ± 10% 50/60Hz
2	N	
3	Channel 1 Loop	Twist this pair
4	Channel 1 Loop	
5	Channel 2 Loop	Twist this pair
6	Channel 2 Loop	
7	Channel 2 Relay	
8	Channel 2 Relay	
9	Earth	
10	Channel 1 Relay	
11	Channel 1 Relay	

6.2 LC20-2-RB 12-24VAC/DC Detektor

11-pin connector wiring

11 POL-Stecker Pol-Nr.	FUNKTION	
1	L	Power supply 12-24V ± 10% AC/DC
2	N	
3	Channel 1 Loop	Twist this pair
4	Channel 1 Loop	
5	Channel 2 Loop	Twist this pair
6	Channel 2 Loop	
7	Channel 2 Relay	
8	Channel 2 Relay	
9	Earth	
10	Channel 1 Relay	
11	Channel 1 Relay	

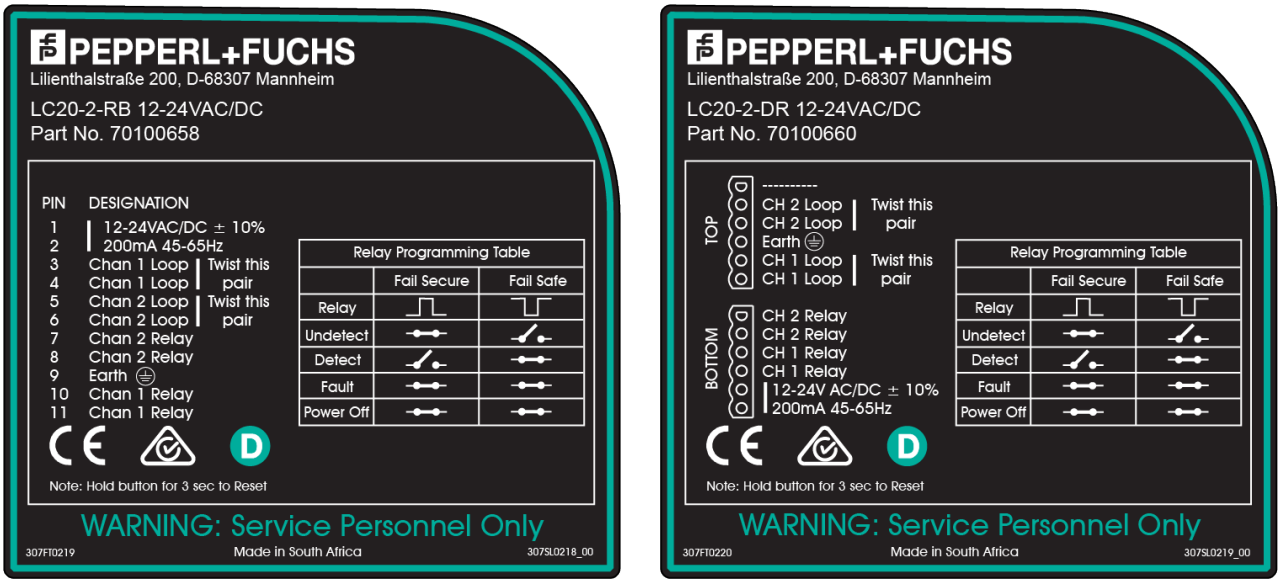
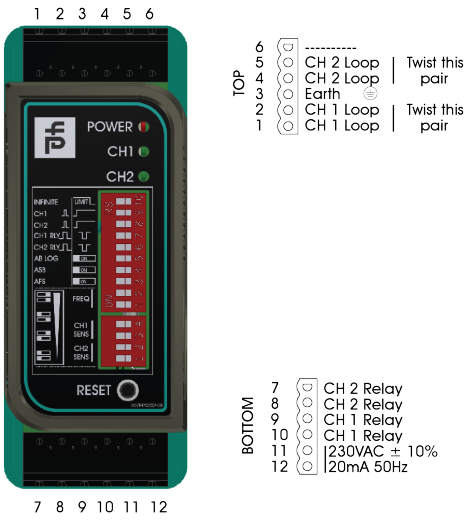


Figure 8. Example of LC20-2 Side Labels. Power supply requirements and pin connections are clearly stated on the side of the unit. 11 Pin configuration is shown on the left, DIN Rail on the right.

6.3 LC20-2-DR 230VAC Detector

DIN Rail connector wiring for LC20-2-DR 230VAC

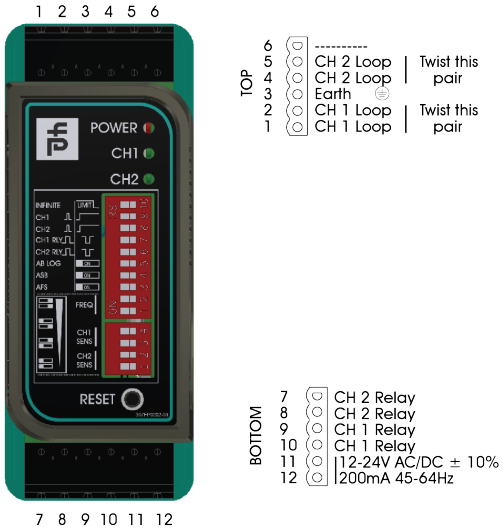
	6 PIN Connector Pin No.	FUNCTION	
Top	1	Channel 1 Loop	Twist this pair
	2	Channel 1 Loop	
	3	Earth	
	4	Channel 2 Loop	Twist this pair
	5	Channel 2 Loop	
	6	Not Connected	
Bottom	7	Channel 2 Relay	
	8	Channel 2 Relay	
	9	Channel 1 Relay	
	10	Channel 1 Relay	
	11	Power supply	
	12	230V AC ± 10% 50Hz	



6.4 LC20-2-DR 12-24VAC/DC Detector

DIN Rail connector wiring for LC20-2-DR 12-24VAC/DC Detector

	6 PIN Connector Pin No.	FUNCTION	
Top	1	Channel 1 Loop	Twist this pair
	2	Channel 1 Loop	
	3	Earth	
	4	Channel 2 Loop	Twist this pair
	5	Channel 2 Loop	
	6	Not Connected	
Bottom	7	Channel 2 Relay	
	8	Channel 2 Relay	
	9	Channel 1 Relay	
	10	Channel 1 Relay	
	11	Power supply	
	12	12-24V ± 10% DC/AC	



7. Applications

The LC20-2 Series dual channel detectors can be used in a variety of applications in the parking and door/gate environments.

- To arm card readers and ticket dispensers
- As a barrier/gate/door closing detector
- As a barrier/gate/door opening detector (Free exit)
- To generate pulses for vehicle counting
- As a logic unit to determine the direction of traffic flow

Some of the features that make the LC20-2 Series detectors ideal for these purposes have been described in the preceding paragraphs.

8. Customer Fault Analysis

8.1 Fault Finding

FAULT	CAUSED BY	REMEDY
Red LED does not glow on power up.	If the indicator is off then there is a fault on the power connection to the unit.	Check power feed to the unit.
After the initial tune period the CH1 and / or CH2 Green Channel LED remains flashing at 2Hz.	Unit cannot tune to the loop due to faulty loop or feeder connection. Loop may be too small or too large. Faulty detector unit.	Check on-board diagnostics to confirm fault. Check loop installation and connections. Check on-board diagnostics to confirm fault. Recut as per installation instructions. Replace unit.
After tuning, the loop output LED flashes and the relay switches quickly.	The loop is getting spurious detects due to: a) Crosstalk with adjacent detector. b) Faulty loop or feeder connection.	a) Change frequency setting. b) Check that the feeders are correctly connected and adequately twisted.
When a Vehicle crosses the loop there is no detect.	a) Loop wire shorted b) The sensitivity of the loop may be set to low (unlikely this is a high sensitivity device).	a) Check the loop resistance it should be less than 6 Ohm b) Set the sensitivity higher
Changing Frequency DIP switches does not initiate a retune	AFS DIP switch need to be switched off to select the frequency manually.	Switch AFS off
Detector remains in detect after the vehicle has left the loop.	a) Faulty Loop b) Poorly Crimped terminals c) Loose connection	a) Perform a Megger test on the loop b) Check Loop connection to terminals c) Check splices are properly soldered and sealed.

8.2 Functional test

To test a detector, connect it to an inductive loop with a total inductance in order of 300 microhenries. (This may be achieved in the workshop by winding (x) turns of wire on a non-metallic former of diameter (y)).

X = 19 turns 0,25mm wire

Y = 238mm (9.4 inches)

Bring a small metal object approximately the size of a matchbox close to the loop coil. The following will happen on detection:

The output LED will light up.

Output relays set to PRESENCE on that channel will operate.

Output relays set to PULSE will operate momentarily (approximately 150ms duration).

To check the sensitivity, presence time etc., use should be made a calibrated tester, which compromises of a calibrated loop similar to the one described above with a moveable vane, which can be moved over the loop at pre-determined heights.

This device together with the on-board diagnostics (obtainable using the LC20-DT) will allow comprehensive analysis of the operating characteristics of the detector.

APPENDIX A - FCC ADVISORY STATEMENT

NOTE: This equipment has been tested and found to comply with the limits of Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

Operation is subject to the following two conditions:

1 This device may not cause harmful interference, and

2 This device must accept any interference received, including interference that may cause undesired operation

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.
Increase the separation between the equipment and receiver.
Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
Consult the dealer or an experienced radio/TV technician for help.

The following booklets prepared by the Federal Communications Commission (FCC) may also prove helpful:

- How to Identify and Resolve Radio-TV Interference Problems (Stock No. 004-000-000345-4)
- Interface Handbook (Stock No. 004-000-004505-7)

These booklets may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

WARNING: **Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.**

APPENDIX B – INSTALLATION OUTDOORS

Appendix B.1 IEC 60950-22 – Outdoor cabinet

If the LC20-2 Series Detector is to be installed outdoors it must be installed in a cabinet / housing that complies with the requirements of IEC 60950-22 for a minimum of pollution degree 2.

Appendix B.2 IEC 60950-22 - Northern Europe

To achieve outdoor operation down to -50 °C as required by IEC 60950-22 for Northern Europe (Finland, Norway and Sweden) a heater with a thermostat must be included in the cabinet that houses the LC20-2 Series Detector.

Appendix B.3 IEC 60950-1 – Overvoltage Category

If the unit is likely to be exposed to transient overvoltage greater that IEC 60950-1 Overvoltage Category II additional protection must be provided external to the unit on the supply lines.

APPENDIX C – REQUEST FOR TECHNICAL SUPPORT FORM

For Technical support please fill in the form below and send it to your supplier. It is recommended that at installation you complete this form as a record of the Installation. If there is a problem later on you can identify what has changed.

For locating faults in "**Inductive Loop Detector"** installations it is highly recommended that you use the diagnostics provided by the LC20-DT.

Contact Details:-

Your Name: _____

Your company: _____

Telephone No. _____ Mobile/Cellphone No. _____

FAX No. _____

Postal address: _____

_____

_____

Product Model (i.e. LC20-2-RB 230VAC) _____

Product Serial Number: (i.e. 70100659):_____

Site Name: _____ Detector No. (at the site): _____

What are the internal settings of the unit :

_____ (Frequency Setting)

_____ (AFS Setting)

_____ (Sensitivity Setting Channel 1)

_____ (ASB Setting)

_____ (Presence Limited or Permanent)

_____ (Sensitivity Setting Channel 2)

_____ (Relay 1 Setting Presence or Pulse)

_____ (Relay 1 Polarity setting)

_____ (Relay 2 Setting Presence or Pulse)

_____ (Relay 2 Polarity setting)

What application is this unit used in (short description)_____

_____

_____

_____

POWER SUPPLY DETAILS:

Nominal Voltage: _____ V Minimum Voltage: _____ V Maximum Voltage: _____ V

AC or DC ? _____ If AC then the Frequency _____ Hz

LOOP DETAILS

Channel 1

Size of loop: ____ m by ____ m

Shape of loop: _____

Number of Turns: _____

Size of wire used (mm^2 or AWG) _____

Type of wire insulation _____

Thickness of insulation:_____ mm

How far below the surface is the loop: _____ mm

Channel 2

Size of loop: ____ m by ____ m

Shape of loop: _____

Number of Turns: _____

Size of wire used (mm^2 or AWG) _____

Type of wire insulation _____

Thickness of insulation:_____ mm

How far below the surface is the loop: _____ mm

Are there any metal objects below the loop such as concrete reinforcing, water pipes etc if yes please give details:

_____

_____

_____

Are there any power cables below these loops (Yes/No) ____ If yes please give details:

_____

_____

_____

Are there any other loops in the area (Yes/No) ____ If so how many? _____ and

how close to these loops are they? _____ m

FEEDER CABLE DETAILS

Channel 1

Length of feeder cable _____ m

Size of wire used (mm^2 or AWG) _____
(should be 1.5 mm^2 or larger)

Type of wire insulation _____

Thickness of insulation:_____ mm

Channel 2

Length of feeder cable _____ m

Size of wire used (mm^2 or AWG) _____

Type of wire insulation _____

Thickness of insulation:_____ mm

Type of feeder cable used (screened, armoured, multicore, etc.)

_____

_____

In the feeder cable how many twists per meter are there?_____ (should be more than 20 per metre)

Are there any other cables close to these feeder cables? (Yes/No) _____ If yes please give details:

_____

FEEDER CABLE and LOOP DETAILS

Channel 1

Is the loop and feeder cable one continuous piece of wire or is there a joint between the loops and the feeder? (Yes/No) _____

Channel 2

Is the loop and feeder cable one continuous piece of wire or is there a joint between the loops and the feeder? (Yes/No) _____

Please give details:_____

_____

With the detector disconnected, measure the following:-

Channel 1	**Channel 2**
AC voltage between the two wires of the feeder cable _____ V	AC voltage between the two wires of the feeder cable _____ V
AC voltage between one of the feeder cable wires and earth _____ V	AC voltage between one of the feeder cable wires and earth _____ V
DC resistance of Feeder plus Loop: _____ ohms	DC resistance of Feeder plus Loop: _____ ohms
Inductance of Feeder plus Loop: _____ µH	Inductance of Feeder plus Loop: _____ µH
Frequency of measurement? _____ KHz	Frequency of measurement? _____ KHz
Loop and feeder resistance to earth (with detector unplugged) using a	Loop and feeder resistance to earth (with detector unplugged) using a
500V Megger: _____ Mega Ohms (should be greater than 10 Mega Ohms)	500V Megger: _____ Mega Ohms (should be greater than 10 Mega Ohms)

READINGS FROM DIAGNOSTICS

Channel 1

Frequency _____ kHz

Frequency Min _____ kHz

Frequency max _____ kHz

Sensitivity Min: _____ %ΔL/L

Sensitivity Max: _____ %ΔL/L

Channel Status:_____

(Undetect, Detect, Open circuit, Short circuit or Indeterminate)

Channel 2

Frequency _____ kHz

Frequency Min _____ kHz

Frequency Max _____ kHz

Sensitivity Min: _____ %ΔL/L

Sensitivity Max: _____ %ΔL/L

Channel Status:_____

(Undetect, Detect, Open circuit, Short circuit or Indeterminate)

Inductance Change for each vehicle type (Use the maximum sensitivity reading and reset the statistics between each reading):

Vehicle Type	Channel 1 Inductance Change	Channel 2 Inductance Change
Bicycle	%ΔL/L	%ΔL/L
Motorbike	%ΔL/L	%ΔL/L
Car	%ΔL/L	%ΔL/L
SUV	%ΔL/L	%ΔL/L
Articulated truck	%ΔL/L	%ΔL/L
5 Ton Tip Truck	%ΔL/L	%ΔL/L
Forklift	%ΔL/L	%ΔL/L
Other type (Please specify)	%ΔL/L	%ΔL/L

Comments: _____

_____

_____