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Short form User Manual

PD230 Enhanced Vehicle Detector

The PD230 is a dual channel microprocessor based detector designed specifically for parking and vehicle access control applications. The PD230 has been designed using the latest technology in order to meet the requirements of diverse parking applications in terms of operating conditions. A number of internal functional options are 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.

The detector is part of a general purpose product range which includes the popular PD130 series of single channel detectors for ease of installation and convenience. Various operating modes are selected by changing the position of switches on the front of the unit and internal jumper selection.

The detector oscillator is multiplexed to eliminate any possibility of crosstalk between the loops connected to the detector.

The switches allow for different loop frequency settings, sensitivity settings and mode settings.

The unit has a number of internally selectable options for configuration of the relay outputs.

The PD230 provides visual outputs (LED) on the front of the enclosure and output relay contacts at the 11 pin connector at the rear of the enclosure. The power LED indicates that the unit has been powered. The channel status LED's below indicate that a vehicle is present over the loop and when there is a fault on the loop. The Presence relays are normally fail-safe and will close on a vehicle detect, loop failure or in the event of a power failure.

1. Table of Contents

2. User Warnings

WARNING: This unit when installed must be correctly earthed!

WARNING: Disconnect power before plugging / unplugging or opening this unit!

WARNING: Installation and service to be undertaken by qualified personnel only!

WARNING: Warranty is void if unauthorised modifications are made to this unit!

WARNING: Ensure safety to vehicles and personnel at sites where this item is installed to control motorised gates. Close off access to vehicles and pedestrians before disconnection or making adjustments!

WARNING: Cutting into post tensioned concrete slabs for loop installation can have catastrophic consequences. As a general rule 30mm is the deepest slot depth allowable in such cases. When any doubt exists the structural engineer's approval must be sought prior to commencement of slot cutting.

3. Principle of Operation

An inductive loop vehicle 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.

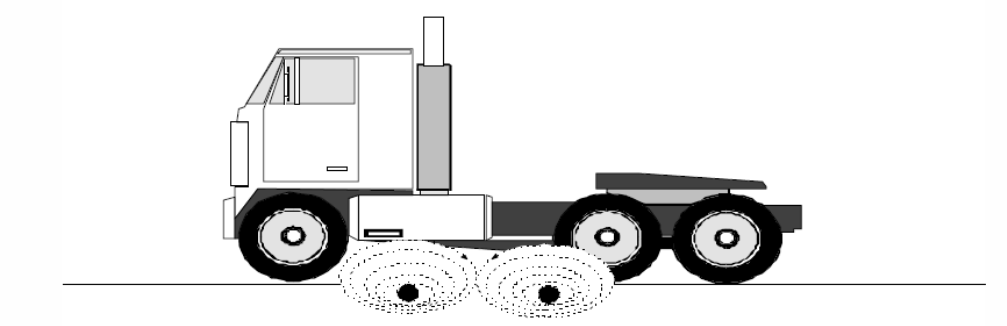


Figure 4.1 Principle of Operation

4. Operating Parameters

4.1. Detector Tuning

Tuning of the detector is fully automatic. When power is applied to the detector upon installation of the system, or when a reset is initiated, the detector will automatically tune itself to the loop to which it is connected. The detector will tune to any loop to inductance range 20 to 1500 microhenries.

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 that keeps the detector correctly tuned.

4.2. Modes of Operation

4.2.1. Presence Mode

In the presence mode the detector will give a continuous output during the presence of a vehicle over the inductive loop. As the detector is designed with the permanent presence feature, the detector in this case will indicate vehicle presence for an unlimited period of time. If the permanent presence is not selected, then the detect time will be dependent on the change of inductance. The presence time on the limited presence setting will be approximately 1 hour for 3% Δ L/L.

The presence output is known as a fail-safe output. This implies that in the event of a loop or power failure the detector will give a detect output. The pulse outputs are not fail safe and will not operate if a fault occurs.

4.2.2. Pulse Mode

When the relay is in a pulse output configuration it will output a pulse of 150 millisecond duration when the vehicle **enters** the loop area.

4.2.3. A-B Logic Mode

In this mode the detector is used as a direction sensor and the primary task is to indicate the direction of travel over the loops. To achieve this two loops are placed in a manner to ensure that a vehicle passes over them in sequence A ⇒ B when travelling in one direction and in reverse order B ⇒ A when travelling in the opposite direction.

In this mode the CH1 relay provides an output when vehicles travel in the direction A ⇒ B and the CH2 relay provides an output when vehicles travel in the direction B ⇒ A.

The "direction" output may be a "presence" or "pulse" output.

The presence output is available from the time that the vehicle reaches the front edge of the second loop in the direction of travel until the vehicle vacates the second loop.

The pulse output occurs at the time the vehicle departs the first loop in the direction of travel having occupied both loops in the correct sequence. If the vehicle backs out while still over the second loop a further pulse is issued on the relay for the other direction, maintaining count accuracy.

Note that for correct operation of the direction logic, the space between the loops must be less than the length of the shortest vehicle to be detected. The minimum distance separating the loops should be 1 metre if the vehicle speed will be greater than 15km/H.

4.3. Hardware configuration

The PD230 Enhanced Vehicle single channel parking detector is designed to be shelf or 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 all connected to the single 11-pin plug, which is mounted at the rear of the enclosure.

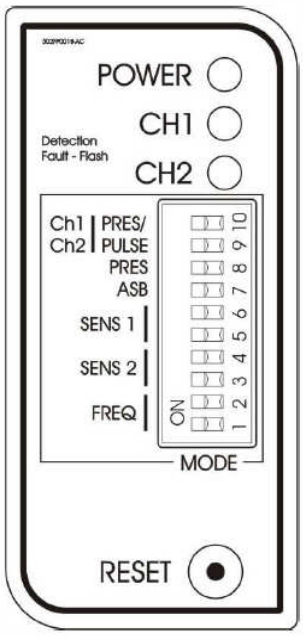


Figure 4.1 PD230 Faceplate layout

5. Switch Settings

5.1.1. Frequency Switch

The frequency switches are the lower two switches, numbered 1 and 2. There are four frequency selections and are set out as follows:

SW2	SW1		
Off	Off	-	High
On	Off	-	Medium-High
Off	On	-	Medium-Low
On	On	-	Low

The frequency switches allow the loop frequency to be shifted higher or lower depending on the switch position. The frequency of the loop is determined by the loop size, and the frequency of the switch simply causes a frequency shift on the loop.

Where more than one detector is used the detectors must be set-up to ensure that there is no cross-talk (interference) between the detectors. This can be achieved by ensuring that the loops of the two detectors are spaced sufficiently apart (approximately 2 meters between adjacent edges) and also ensuring that the detectors are set to different frequencies. As a general rule, the detector connected to the inductive loop with the greatest inductance should be set to operate at the lowest frequency. Loop inductance increases as loop size, number of turns in the loop and feeder length increases.

When the switch selection is altered, the frequency on both loops will change as the unit is multiplexed and therefore use a common oscillator. There is no possibility of interference between the loops connected to a single dual channel detector owing to the multiplexing function.

5.1.2. Sensitivity Switch

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 sensitivity of the detector allows the detector to be selective as to the change of inductance necessary to produce an output. There are four sensitivity selections and are set as follows: -

CH1	SW6	SW5		
CH2	SW4	SW3		
	Off	Off	-	High
	On	Off	-	Medium-High
	Off	On	-	Medium-Low
	On	On	-	Low

5.1.3. Automatic Sensitivity Boost

Automatic sensitivity boost is a mode that alters the “undetect” level of the detector. This mode is selected by switch No. 7 on the front of the enclosure and is as follows: -

SW7		
Off	-	Disabled
On	-	Enabled

Automatic sensitivity boost causes the sensitivity to be boosted to a maximum on detection of a vehicle, and maintained at this level during the presence of the entire vehicle over the loop. When the vehicle departs the loop and the detection is lost the sensitivity reverts to the pre-selected level.

5.1.4. Presence Time

The presence time may be set to permanent presence in which case the presence output is maintained indefinitely, to the detriment of the environmental compensation that operates only when the loop is unoccupied.

In limited presence mode there will be a finite time that the detector will remain in detect. This time is dependent on the change of inductance that the vehicle caused. The presence time on the limited presence setting will be approximately 1 hour for 3% Δ L/L.

The presence mode is set with switch No. 8 and is configured as follows: -

SW8		
Off	-	Limited Presence
On	-	Permanent Presence

5.1.5. Pulse / Presence selection

The output relay for each channel may be set to either **Pulse Mode** or **Presence Mode**
Presence mode provides a continuous output for the duration of the vehicle presence (subject to presence time setting).
Pulse or presence mode is set with switches No. 9 & No.10 as shown in the table below: -

CH1	CH2		
SW10	SW9		
Off	Off	-	Presence
On	On	-	Pulse

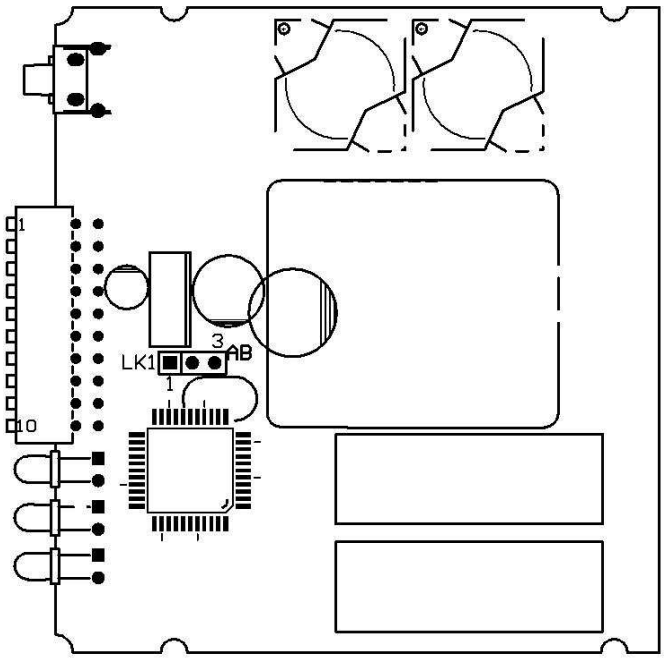
5.1.6. Reset Switch

The detector automatically tunes to the inductive loop connected to it when the power is applied, whether on initial installation or after any break in power supply. Should it be necessary to re-tune the detector, as may be required after changing any of the switches or after moving the detector from one installation to another, momentary operation of the RESET switch will initiate the automatic tuning cycle.

5.2. Internal Link Selection

There are one 3 way link located inside the PD230 that is used to configure the AB Logic options. This link has been placed inside the unit to avoid incorrect operation due to selection by unauthorised persons.

The internal link selections are illustrated in the following diagram.



LK1	AB Logic Selection
LK1 3 1 Link from Pin 1 to Pin 2	Presence AB Logic
LK1 3 1 Link from Pin 2 to Pin 3	Pulse AB Logic
LK1 3 1 Link open Leave link on Pin 2 only	No AB Logic

For a description of the AB Logic mode refer to section 4.2 - "Modes of Operation"

Figure 5.1 PD230 Internal switch selection

5.3. Front Panel Indicators

While the detector is tuning, the Channel LED will indicate the "mode" status of the detector.

i) Any Channel output operating in the presence or pulse modes will come on and extinguish when the system is tuned.

ii) When the AB Logic mode is selected, the Channel LED's will alternatively slow flash and extinguish when the system is tuned.

If a loop fault exists the Channel LED will permanently flash indicating a fault. If the fault is self-healing the detector will continue to operate but the LED will continue to show the historical fault. The detector must be reset or power removed to clear the historical fault information.

The channel LED will also illuminate whenever a vehicle is detected passing over the inductive loop.

The Red Power LED will remain on to indicate that the unit is powered. This LED is also used as the link to the diagnostic unit (DU100).

6. Technical Data

6.1.1. Functional Data

Tuning	Fully Automatic
Self-tuning range	20µH to 1500 µH
Sensitivity	Four step switch selectable High 0.02% ΔL/L Medium High 0.05 %ΔL/L Medium Low 0.10 %ΔL/L Low 0.50 %ΔL/L
Frequency	Four step switch selectable Frequency dependent on loop size
Automatic Sensitivity Boost	Switch selectable
Outputs	Output relays may operate in the Presence (fail-safe), Pulse or Direction logic modes
Presence Time	Switch selectable: Limited presence / Permanent presence
Pulse Relay	Switch selectable: Pulse on detect / Pulse on undetect
Pulse Output Duration	150 milliseconds
Response Times	100 milliseconds
Drift Compensation Rate	Approx. 1%ΔL/L per minute
Visual Indications	1 x Power LED – Red 2 x Channel Status LED - Green
Reset	Push button on front of enclosure
Surge protection	Loop isolation transformer, gas discharge tubes and Zener diode clamping on loop input

6.2. Electrical and Environmental Data

Power requirements	12 V -10% to 24 V +10% (PD234) 230 VAC ± 10% (48 to 62Hz) (PD232) 1.5 VA Maximum @ 230 V
Relay Contact Rating	Relays rated - 5 A @ 230 VAC Factory Option - Opto Isolated 50mA @ 30VDC
Storage Temperature	-40° to +80°C
Operating Temperature	-40° to +70°C
Humidity	Up to 95% relative humidity without condensation
IP Rating	IP30

6.3. Mechanical Data

Housing Material	ABS blend
Mounting Position	Shelf or DIN rail mounting
Connections	11-pin Sub-magnal (JEDEC No. B11-88)
Size of Housing	78mm (H) X 41mm (W) X 80mm (D)

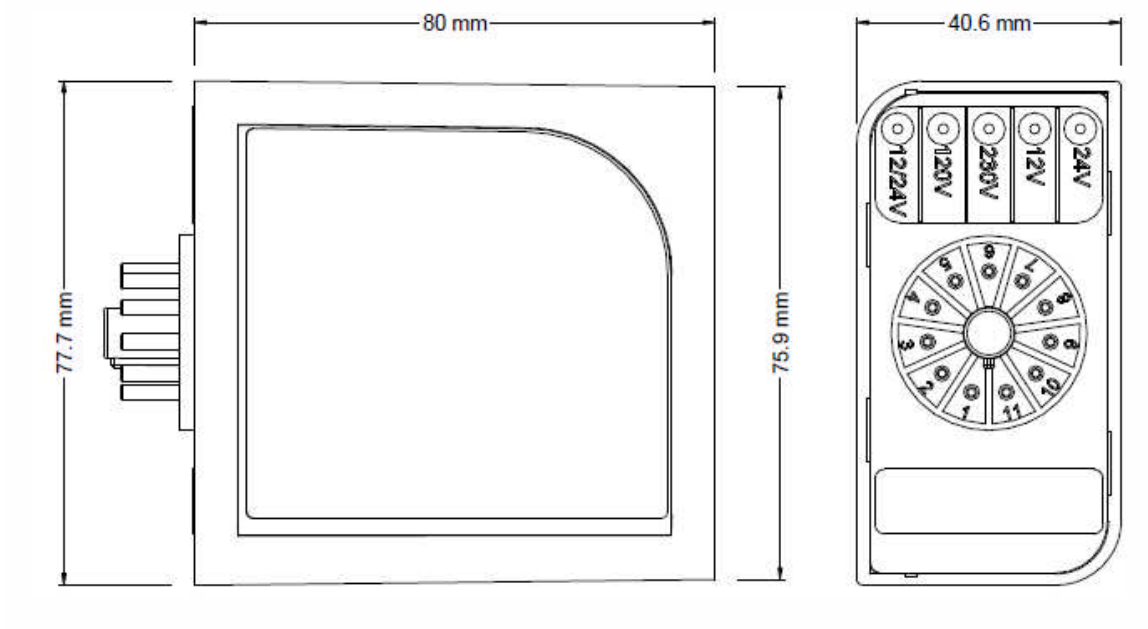


Figure 3.2 PD130 Housing dimension

7. Wiring Connections

11 PIN CONNECTOR WIRING CODE (BEIGE)

PIN	COLOUR	DESIGNATION	
1	Red	Live	230V AC 50/60 Hz
2	Black	Neutral	OR 12 - 24V AC/DC
3	Blue	Channel 1 loop	Twist
4	Blue	Channel 1 loop	this pair
5	Yellow	Channel 2 loop	Twist
6	Yellow	Channel 2 loop	this pair
7	Grey	Channel 2 N/O	
8	Grey	relay contacts	
9	Green/Yellow	Earth	
10	White	Channel 1 N/O	
11	White	relay contacts	

8. 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 weatherproof location as close as possible to the loop.

8.1. Operational Constraints

8.1.1. Crosstalk

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

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 electric cables. The screen must be earthed at the detector end only.

NOTE DUAL CHANNEL DETECTORS ELIMINATE CROSSTALK WHEN TWO LOOPS ARE CONNECTED TO THE SAME DETECTOR.

ADJUSTMENT TO OPERATING FREQUENCY AND LOOP SEPARATION REQUIREMENTS DO NOT APPLY UNLESS MORE THAN ONE DETECTOR MODULE IS INSTALLED

8.1.2. 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. Hence, where reinforcing exists 2 turns should be added to the normal loop, as referred to in section 5.3.

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 the feeder remains exposed after the sealing compound has been applied.

8.2. Loop and Feeder Specification

The loop and feeder should preferably constitute a single unjoined length of insulated copper conductor, with a minimum rating 15Amp.

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.

8.3. Sensing Loop Geometry

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

The length of the loop will be determined by the width of the roadway to be monitored. The loop should reach to within 300mm 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 or more. Loops having a circumference measurement less than 6 metre should have four turns. It is good practice at time of installation to construct adjacent loops with alternate three and four turn windings.

9. Loop Installation

All permanent loop installations should be installed in the roadway by cutting slots with a masonry cutting disc or similar devise. 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: 45mm
NOMINAL SLOT DEPTH : 30mm TO 50mm

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

A continuous loop and feeder is obtained by leaving a tail long enough o reach the detector before inserting the cable into the loop slot. Once the required number of turns of wire is 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 “quick-set” black epoxy compound or hot bitumen mastic to blend with the roadway surface.

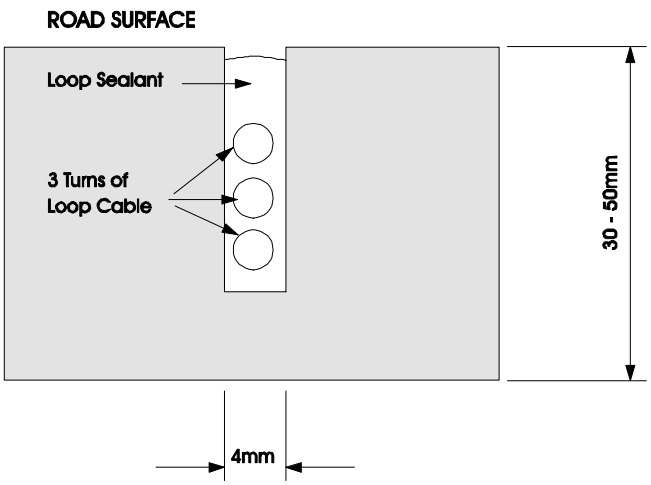


Figure 10.1 Slot details

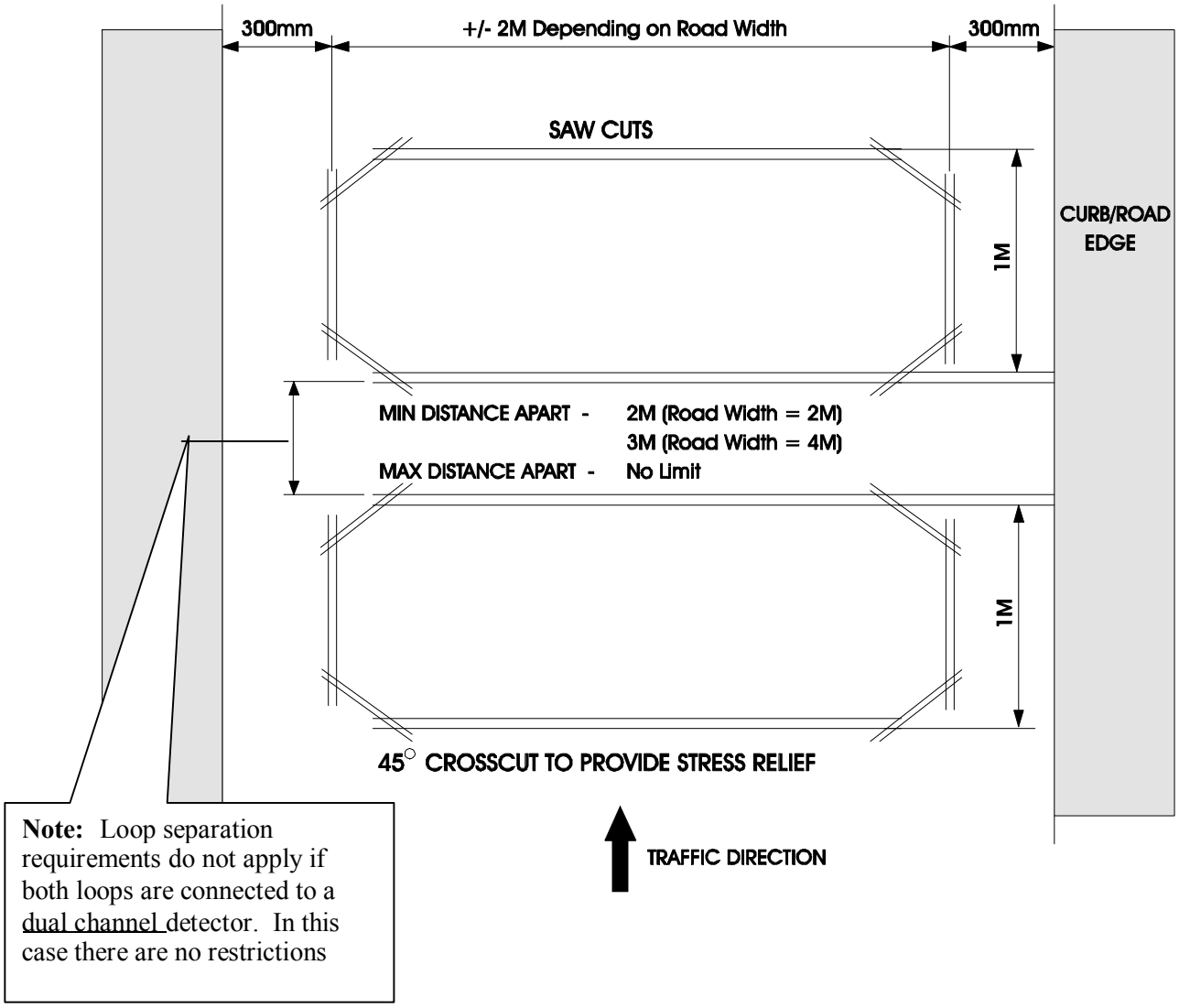


Figure 10.2 Adjacent loops connected to different detector modules

10. Part Numbers

Part Number	Model Number	Description
302FT0026_01	PD232 - Enhanced	230 V ac operation
302FT0054_01	PD232 - Enhanced	230 V ac operation N/C Relay contacts
302FT0063_01	PD232 - Enhanced	230 V ac operation Ch 1 = N/O Relay contact Ch 2 = N/C Relay contact
302FT0008_01	PD234 - Enhanced	12 - 24V ac/dc operation
302FT0078_01	PD234 - Enhanced	12 - 24V ac/dc operation N/C Relay contacts
895FT 0001	DU100 - English	Hand Held Diagnostic Unit
302FT0041	Wiring Harness	Option - 1 metre plug and harness
CTR119090		DIN Rail Screw terminal base

11. Fault Finding

FAULT	CAUSED BY	REMEDY
Red LED does not glow on power up.	If the indicator is off then there is a fault with the power connection to the unit.	Check power feed to the unit.
Both Green LED's alternatively slow flash while the detector is tuning	A-B (Direction) Logic mode has been selected.	If this is not required, see section 4.2.3 for details to alter this setting.
After the initial tune period one or both Green LED's flash continuously (ON for 1 second and OFF for ½ second).	i) Unit cannot tune to the loop due to faulty loop or feeder connection. ii) Loop inductance may be too small or too large. iii) Faulty detector unit.	i) Check loop installation and connections. ii) Re-cut loop as per installation instructions. iii) Replace unit.
After tuning, the loop output LED flashes intermittently and the relay chatters.	The detector is giving spurious detects due to: a) Crosstalk with adjacent detector. b) Faulty loop or untwisted loop feeder connection. c) Electrical interference	a) Change frequency setting on one unit. b) Check that the feeders are correctly connected **and adequately twisted.** c) Isolate sources of nearby electrical equipment and high voltage cables

12. Warranty

i. A conditional 24-month Warranty is offered on all items covering faulty workmanship or materials.
ii. Warranty is calculated from the unit serial number which incorporates the date of manufacture.
iii. Goods for return under warranty are to be returned to the Company at the customer's expense.
iv. Goods repaired or exchanged under warranty will be returned to a customer at our expense.
v. Warranty specifically excludes any on site service obligation or liability for any 3rd party equipment malfunction or damage, and excludes damage by fire, electrocution, accident, misuse, or abuse, or other cause beyond the normally intended use of the product.

Return Address for warranty items

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MORNINGTON TAS 7018

Post : Nortech Detection Pty Ltd
P.O. Box 2104
HOWRAH TAS 7018

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