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TD136 Enhanced Vehicle Detector User Manual

Document Number: 301UM0031_01
Date of Issue: September 2009

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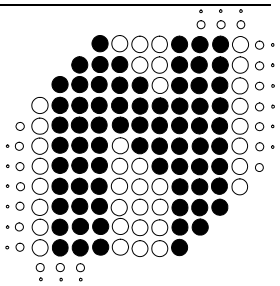

TD136 Enhanced Vehicle Detector User Manual

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Table of Contents

WARNING: 1. This unit must be 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. Only service personnel may open the unit to change 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 2002/96/EC 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 TD136 Enhanced Vehicle Detector is a single channel microprocessor based detector designed specifically for traffic control applications. The TD136 Enhanced Vehicle Detector has been designed using the most up-to-date technology in order to meet the requirements of a vast number of traffic applications in terms of operating conditions and functional 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. The detector has been designed for ease of installation and convenience.

The detector has been designed for ease of installation and convenience. The various modes are selected by changing the positions of the switch on the front of the unit.

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

The TD136 Enhanced Vehicle Detector provides visual output (LED) on the front of the enclosure and relay change-over contacts are taken on the 11 pin connector at the rear of the enclosure. The LED indicates the power has been applied to the unit, that a vehicle is present over the loop and if there is a fault on the loop.

The Presence relay is fail-safe and will close on a vehicle detect or in the event of power failure. The TD136 Enhanced Vehicle Detector is also provided with an integral fault relay, which will provide an output in the event of a loop fault condition.

Related Documents:

TD136 Enhanced Vehicle Detector Data Sheet Document No. 305DS0002

Installation Leaflet Document No. 300LF0006

Diagnostic Unit DU100 User Manual Document No. 895UM0001

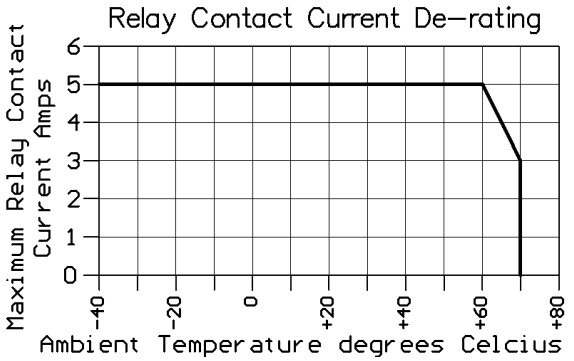
2. TECHNICAL DATA

2.1 Functional Data

Tuning	Fully Automatic
Self-tuning range	20 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
Relay Outputs	Presence Relay Fault Relay
Presence Relay	Fail-safe
Presence Time	Switch selectable: 1 Second 4 Minutes 40 Minutes No fixed time-out (dependant on inductance change) Approx. 1 hour for 3 %ΔL/L
Delay Time	Switch selectable: 0 Seconds 10 Seconds 20 Seconds 30 Seconds
Fault Output	Separate fault monitor output relay Operates under the following conditions: 1. Loop open/short circuit 2. Detector/power fault
Response Times	Turn – on 60 milliseconds Turn – off 60 milliseconds
Drift Compensation Rate	Approx. 1 %ΔL/L per minute
Visual Indications	1 X Power LED - Red 1 x Channel Status LED - Green
Reset	Reset by push button on front of enclosure
Surge protection	Loop isolation transformer, gas discharge tubes, and Zener Diode clamping on loop input

2.2 Electrical Data

Power requirements	12 V -10% to 24 V +10% DC/AC 48 to 62 Hz 120 V_{AC} ±10% (48 to 62 Hz) 230 V_{AC} ±10 % (48 to 62 Hz) Requirement: 1.5 VA Maximum @ 230 V
Relay Contact Rating	Relays rated – 5 A @ 230 V_{AC} Optional – Opto Isolated 50mA @ 30V_{DC} For ambient temperatures above 60℃ De-rate the rel ay Maximum current as per graph below

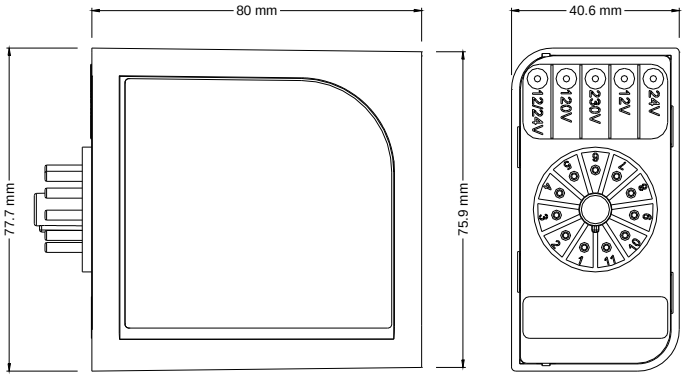


2.3 Environmental Data

Storage Temperature	-40℃ to +80℃
Operating Temperature	-40℃ to +70℃
Humidity	Up to 95% relative humidity without condensation
Circuit protection	Conformal coating over the PCB and all components
IP Rating	IP30

2.4 Mechanical Data

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



2.5 Approvals

CE Regulations:	EN 301 489-3	Equipment Type: III Class of Equipment: 2
	EN 50293	Performance Criteria B
Safety	IEC / EN 60950-1	

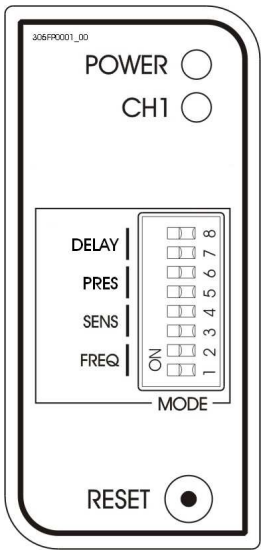
3. OPERATING INSTRUCTIONS

3.1 Hardware Set-up

The TD136 Enhanced Vehicle Detector is a single channel traffic detector 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.

3.2 Switch Setting Selections



3.2.1 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 allows the loop 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 metres 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.

3.2.2 Sensitivity

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

SW4	SW3	
Off	Off	High
On	Off	Medium-High
Off	On	Medium-Low
On	On	Low

3.2.3 Presence Time

The presence time is a mode, which allows the detector to have a presence time of no longer than the time set. The mode is selected by switches No.5 and 6 on the front of the enclosure and is as follows: -

SW6	SW5	
Off	Off	∞ no fixed time
On	Off	40 min
Off	On	4 min
On	On	1 sec

The presence time as shown above may be altered according to the requirements.

The 1 second setting will give a pulse on detection of a vehicle with a duration of 1 second. The detector will immediately re-adjust to the normal operating point and will give another detect in the event of a further change in the loop inductance, i.e. the detector may be used as a passage detector in this mode.

The 4 minute and 40 minute settings work in the same way as the 1 second setting; however the detector will now give outputs of 4 minutes or 40 minutes. If the vehicle which caused the inductance change moves off the loop then the detector will go out of detect and this time will be reset to zero for the next detect cycle. The detector may undetect before the expired time period if the change in inductance for the vehicle is small.

The “no fixed time-out” setting does not have a fixed time period and the presence time is dependant on the magnitude of the inductance change caused by the vehicle over the loop.

On times longer than 1 second there will be a “paralysis time” of approximately 2 seconds between actuations.

3.2.4 Delay Time

Delay time is a mode in which the output of the detector is delayed by the time specified. If the vehicle leaves the loop before the time has expired, no output will result. The mode is selected by switches No.7 and 8 on the front of the enclosure and is as follows:

SW8	SW7	
Off	Off	Off
On	Off	10 secs
Off	On	20 secs
On	On	30 secs

3.2.5 Reset Switch

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

3.3 Front Panel Indicator

While the detector is tuning, the ON (Red) LED will glow .The OUTPUT LED (Green) will extinguish when the system is tuned. The green LED will flash at a rate of 1 Hz during tuning. This is used to indicate the frequency of the loop to the user. Every flash of the LED is equivalent to 10 kHz. It will stop when the operating frequency is reached. This operation is also performed whenever the reset button is depressed.

The ON (Red) LED will glow permanently to indicate that the unit is functional. The red LED also serves as an optical interface to the DU100 Diagnostic Unit.

If faults exist with the loop the green LED will come on and flash off at the rate of 2Hz indicating the fault. If the fault is self-healing the detector will continue to operate but the LED will remain on indicating to the user that a fault has occurred. The LED will go off for a moment during an undetect indicating this, thereafter returning on. This condition can be restored by removing the power or by depressing the reset button.

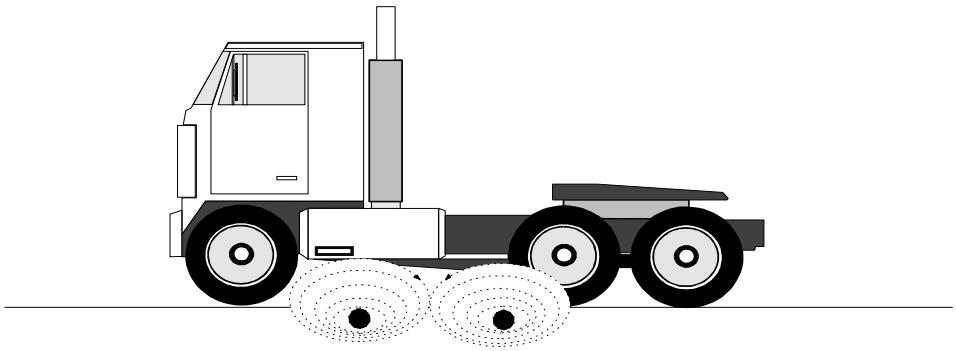
The green LED will also glow whenever a vehicle is detected passing over the inductive loop.

4. PRINCIPAL OF OPERATION

The 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.



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, 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.

Sensitivity levels of the TD136 Enhanced Vehicle Detector have been carefully optimized for traffic control applications.

The nature of the application determines the required sensitivity, which may be adjusted by means of the sensitivity, switches on the front of the enclosure.

4.3 Modes of Operation

In the presence mode the detector will give a continuous output during the presence of a vehicle over the inductive loop providing that the preset time has not expired. Upon expiry the detector will undetect and tune out the vehicle over the loop.

The presence output is known as a fail-safe output. This implies that in the event of a power failure the detector will give a detect output. The fault relay is also failsafe and will generate an output whenever a loop is faulty or the unit is unable to tune to the loop.

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 TD136 Enhanced Vehicle Detectors have been adjusted to provide adequate response to vehicles in traffic control applications.

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 weatherproof location as close as possible to the loop.

5.1 Product Safety Requirements

- **WARNING:** The unit must be EARTHED**.**
- **WARNING:** Disconnect the power before working on the unit**.**
- **WARNING:** On 120 V_{AC} and 230 V_{AC} models a readily accessible disconnect device MUST be incorporated into the Mains wiring (As per EN 60950 section 1.7.2)
- **WARNING:** 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 section 1.7.11) typically this will be a 5 Amp Magnetic Circuit Breaker for AC models and a fuse for DC models.
- **WARNING:** This product must be installed in an enclosure.
- **WARNING:** No user serviceable parts inside. Warranty void if cover removed. **ONLY SERVICE PERSONNEL MAY OPEN THE UNIT TO CHANGE THE INTERNAL SETTINGS.**
- **WARNING:** Only use **CE** approved 11 pin relay bases such as Nortech Part No. CTR119090 or equivalent.

  As an alternative to the 11 pin realy base, Nortech has a 11 pin wiring harness, Nortech Part No. 301FT0041, which can only be used in SELV voltage (less than 60 V_{DC} or less than 42 V_{AC}) applications.

5.2 Operational Constraints

5.2.1 Environmental Factors to Consider

Even though the TD136 Enhanced Vehicle 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 TD136 Enhanced Vehicle parking detectors are rated to operate over the industrial temperature range but the rate of temperature change MUST not exceed 1℃ 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.

For additional information on **Environmental Factors** refer to the section “Environmental Influences to Design Parameters” in the “Loops and Loop Installations” Manual, Nortech Document No. MKT05.

5.2.2 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.

4. Running feeder cables in their own slots, separated by at least 300mm

   For additional information on **Crosstalk** refer to the section “Crosstalk Prevention” in the DU100 Diagnostic Unit User Manual Nortech Document No. 895UM0001.

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. Hence, where reinforcing exists 2 turns should be added to the normal loop, as referred to in section 5.4.

The spacing between the loop and steel reinforcing should be greater than 150 mm, 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.

5.3 Loop and Feeder 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, and 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.

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 mm2. The feeder is twisted to minimize 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 m² and must be not less than 1 m².
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 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 metres should have four turns. It is good practice at time of installation to construct adjacent loops with alternate three and four turn windings.

For additional Information on loop geometry refer to the following documents:
“INDUCTIVE LOOP VEHICLE DETECTION” – Nortech Doc. No. MKT01.
“TRAFFIC DETECTION CONCEPTS” – Nortech Doc. No. MKT02.
“TRAFFIC APPLICATION MANUAL” – Nortech Doc. No. MKT04

5.5 Loop Installation

All permanent loop installations should be installed in the roadway by cutting slots with a masonary 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: 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 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.

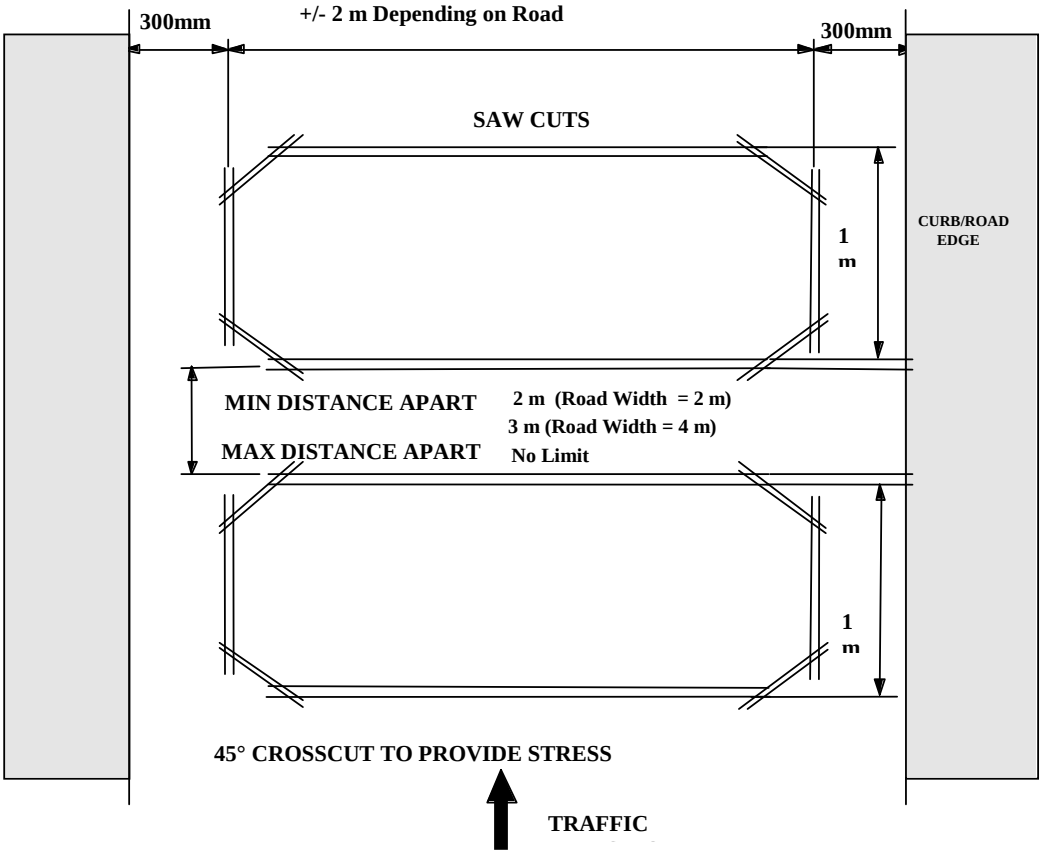


Figure 5.1 Adjacent loops connected to different detector modules

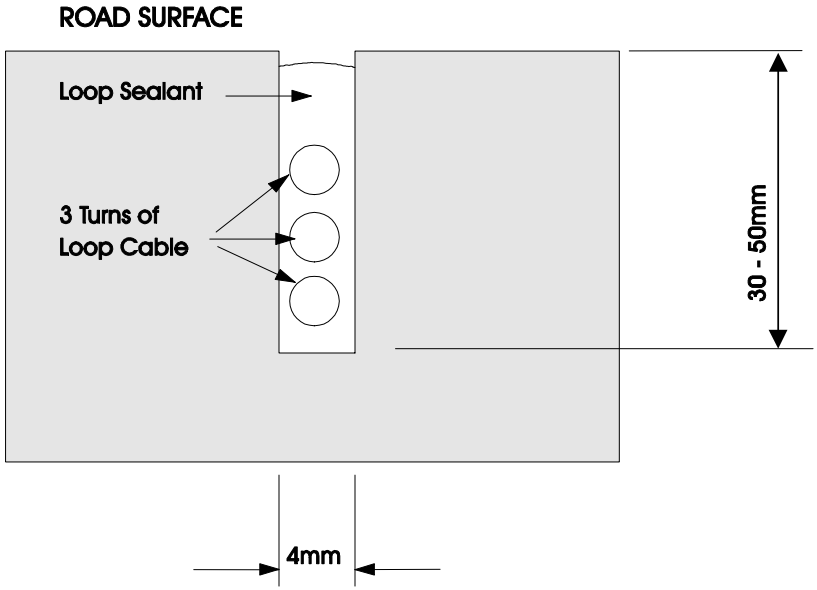


Figure 5.2 Slot Details

6 CONFIGURATION

WARNING: 8. The connector PIN assignments vary from model to model

Refer to the label on the side of the unit for connector PIN assignment.

NOTE 1: The tables below show the PIN assignments for Nortech's standard TD136 Enhanced models on other models the pin assignments may change.

WARNING: 9. The wiring harness is only rated for SELV voltages (less than 60Vdc or less than 42Vac).

If the relays are to switch higher voltages use CE LVD approved 11 pin sockets

NOTE 2: All relay contact descriptions refer to the tuned and undetected state.

6.1 TD136 Enhanced – 120 V_{AC} Vehicle Detector - Order number 305FT0004

11-pin connector wiring for TD136 Enhanced Vehicle – 120 V_{AC} Detector - Order number 305FT0004

301FT0045 Wiring Harness Wire COLOUR	11 PIN Connector Pin No.	FUNCTION	
Red	1	Live	Power supply
Black	2	Neutral	230V 10% 50/60 Hz
Grey	3	Fault Relay N/O	
Violet	4	Fault Relay Common	
Yellow	5	Presence Relay N/O	
Brown	6	Presence Relay Common	
Blue	7	Loop	Twist this
Blue	8	Loop	Pair
Green/Yellow	9	Earth	
Pink	10	Presence Relay N/C	
White	11	Fault Relay N/C	

WARNING: 10. The wiring harness wire colour to PIN No. assignment only applies to wiring harness Part No. 301FT0045. Other wiring harnesses will have different wire colour to PIN No. assignments

6.2 TD136 Enhanced – 230 V_{AC} Vehicle Detector - Order number 305FT0001

11-pin connector wiring for TD136 Enhanced Vehicle – 230 V_{AC} Detector - Order number 305FT0001

301FT0041 Wiring Harness Wire COLOUR	11 PIN Connector Pin No.	FUNCTION	
Red	1	Live	Power supply 230V 10% 50/60 Hz
Black	2	Neutral	
Grey	3	Fault Relay N/O	
Violet	4	Fault Relay Common	
Yellow	5	Presence Relay N/O	
Brown	6	Presence Relay Common	
Blue	7	Loop	Twist this Pair
Blue	8	Loop	
Green/Yellow	9	Earth	
Pink	10	Presence Relay N/C	
White	11	Fault Relay N/C	

WARNING: 11. The wiring harness wire colour to PIN No. assignment only applies to wiring harness Part No. 301FT0041. Other wiring harnesses will have different wire colour to PIN No. assignments

6.3 TD136 Enhanced – 12 to 24 $V_{AC/DC}$ Vehicle Detector - Order number 305FT0010

11-pin connector wiring for TD136 Enhanced Vehicle – 12 to 24 $V_{AC/DC}$ Detector – Order number 305FT0010

301FT0041 Wiring Harness Wire COLOUR	11 PIN Connector Pin No.	FUNCTION	
Red	1	Live	Power supply 12V –10% to 24V +10% AC/DC
Black	2	Neutral	
Grey	3	Fault Relay N/O	
Violet	4	Fault Relay Common	
Yellow	5	Presence Relay N/O	
Brown	6	Presence Relay Common	
Blue	7	Loop	Twist this Pair
Blue	8	Loop	
Green/Yellow	9	Earth	
Pink	10	Presence Relay N/C	
White	11	Fault Relay N/C	

WARNING: 12. The wiring harness wire colour to PIN No. assignment only applies to wiring harness Part No. 301FT0041. Other wiring harnesses will have different wire colour to PIN No. assignments

7. APPLICATIONS

The TD136 Enhanced Vehicle single channel Detector can be used in a variety of applications in the traffic and vehicle control environments.

For VA (Vehicle Actuated) or SVA (Semi Vehicle Actuated) traffic intersection control

Some of the features that make the TD136 Enhanced Vehicle Detector ideal for these purposes have been described in the preceding paragraphs.

For more details on traffic applications, refer to “Traffic Applications Manual”, Document No. MKT0004.

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 Green LED flashes (ON for 1 second and OFF for ½ second)	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 loop installation and connections. Recut as per installation instructions. Replace unit.
After tuning, the loop output LED flashes *intermittently* and the relay chatters.	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.

8.2 DU100 – DETECTOR DIAGNOSTIC UNIT

The DU100 Diagnostic unit is a hand-held test instrument that has been designed to operate with the TD136 Enhanced Vehicle Detector to provide installation / service personnel with positive verification of the correct installation and operation of the vehicle detector.

The following parameters may be verified using this instrument:

1. Detector type and version

2. Loop status — Display of loop frequency and magnitude of current change of loop inductance %ΔL/L.

3. Frequency — Readout of the actual loop operating frequency and the magnitude of the frequency drift since the last re-tune.

4. Sensitivity — Displays the Minimum and Maximum changes of Inductance %ΔL/L that caused a detect since the last re-tune.

5. Status — Displays the current status of the detector i.e. Undetect, Detect, Open circuit, Short circuit or Indeterminate.

6. Time — The time in days and hours since the last re-tune and the reason for the last re-tune i.e. Reset: manual or power failure, Loop short circuit, Loop open circuit, Indeterminate or an Inductance change of greater than 15 % Δ L/L (typical)

   This historical information is invaluable in providing information about intermittent faults.

7. Crosstalk — Allows for the comparison of the operating frequencies of detector loops in close proximity to each other. If the operating frequencies are to close the DU100 test will indicate a failure.

For further information refer to the Diagnostic Unit DU100 User Manual Document No. 895UM0001.

It is highly recommended that after installation of a detector (or if the loop has been changed in any way) that the DU100 Diagnostics Unit is used to verify the correct operation of the detector. A record of the readings should be kept so that if there is a problem in the future a comparison can be made to identify what has changed. The form in Appendix A could be used to record these readings.

8.2.1 Interpretation of DU100 readings

8.2.1.1 Frequency

For the TD136 Enhanced Vehicle Detector the Minimum frequency is 12 kHz and the Maximum frequency is 85 kHz

If a 20 μH loop is connected directly (no feeder cable) to the Detector and the Frequency switches are set to “High Frequency” the typical frequency would be 84 kHz

If a 1500 μH loop is connected directly (no feeder cable) to the Detector and the Frequency switches are set to “Low Frequency” the typical frequency would be 13 kHz

If the Frequency reading from the DU100 is close to the Maximum Frequency the inductance of the LOOP is too small – you need to add turns to the loop

If the Frequency reading from the DU100 is close to the Minimum Frequency the inductance of the LOOP is too high and you need to remove turns from the loop

If the detector is operating close to either limit it is possible that either the frequency drift caused by environmental changes or the shift in frequency caused by a large ΔL/L detect will cause the frequency to go outside the limits and cause a retune.

8.2.1.2 Frequency drift

The TD136 Enhanced Vehicle Detector can handle environmental conditions that cause the frequency to drift up to at a rate of approximating 1%ΔL/L per minute.

If the Drift reading approaches this value the detector will have problems tracking the environmental change

If the drift is higher than say 0.5 %ΔL/L per minute this will indicate a possible fault with the loop or feeder cable. Possibly the wire insulation has deteriorated and moisture is causing a short to earth or that wires of the loop are no longer encapsulated and are moving.

For more information about Frequency drift refer to the "Theory of Application" section in Diagnostic Unit DU100 User Manual Document No. 895UM0001

8.2.1.3 Sensitivity

For a standard loop of 1.0 metres by 2.0 metres with 2 turns (circumference less than 10 m) and a ten meter feeder cable the following table shows typical sensitivity values for different vehicle types

VEHICLE TYPE	**%ΔL/L**
Metal Supermarket Trolley	0.3 to 2
Bicycle	0.04
Motorbike	0.12
Articulated Truck	0.38
Four Wheel Drive	0.40
5 Ton Tip Truck	0.45
Motor Car	> 1.00
Forklift	> 1.00

For more information about Sensitivity refer to the "Theory of Application" section in Diagnostic Unit DU100 User Manual Document No. 895UM0001

8.2.1.4 Time

This is a powerful tool in identifying problems with an installation. The time since the last retune of the detector will let you know when the event occurred and the reason will inform you of what caused the event

8.2.1.5 Crosstalk

For information about resolving crosstalk refer to the “Theory of Application” section in Diagnostic Unit DU100 User Manual Document No. 895UM0001

8.3 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 non-metal former of diameter (y)).

X = 19 turns 0,25 mm wire

Y = 238 mm (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

The PRESENCE output relay will operate

The PULSE relay will operate momentarily (approximately 150ms duration)

To check the sensitivity, presence time etc., a calibrated tester should be used, 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 DU100 hand-held test instrument 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 for a **Class B** digital device, pursuant to 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: 13. 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 60950-22:2005 – Outdoor cabinet

If the PD136 Enhanced Detector is to be installed outdoors it must be installed in a cabinet / housing that complies with the requirements of IEC 60950-22:2005 for a minimum of pollution degree 2.

Appendix B.2 IEC 60950-22:2005 - Northern Europe

To achieve outdoor operation down to -50 ℃ as requ ired by IEC 60950-22:2005 for Northern Europe (Finland, Norway and Sweden) a heater with a thermostat must be included in the cabinet that houses the PD130 Enhanced Detector.

Appendix B.3 IEC 60950-1:2005 – 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 "**Nortech Inductive Loop Vehicle Detector"** installations it is highly recommended that you use the DU100 DIAGNOSTICS UNIT. Please refer to the DU100 user manual Doc. No. 895UM0001 for details of how to operate the DU100.

Contact Details:- Your Name: _____

Your company: _____

Telephone No. _____ Mobile/Cellphone No. _____

FAX No. _____ E-mail: _____

Postal address: _____

_____

_____

Product Model (i.e. TD136 Enhanced Vehicle Detector) _____

Product FT No. 305FT_____ Product Serial Number: _____

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

What are the settings of the switches on the front of the unit ON or OFF

Switch 1 _____ (FREQ Frequency)

Switch 2 _____ (FREQ Frequency)

Switch 3 _____ (SENS Sensitivity)

Switch 4 _____ (SENS Sensitivity)

Switch 5 _____ (PRES Presence Time)

Switch 6 _____ (PRES Presence Time)

Switch 7 _____ (DELAY Delay Time)

Switch 8 _____ (DELAY Delay Time)

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

Size of loop: ___ m by ___ m Shape of loop: _____

Number of Turns: _____

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

Type of wire insulation and thickness of insulation:_____

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 the loop if yes please give details:

_____

_____

_____

Are there any other loops in the area if so how many? _____ and how close to this loop are they? _____ m

FEEDER CABLE DETAILS

Length of feeder cable_____m

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

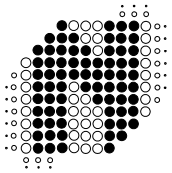
Type of wire insulation and thickness of insulation:_____ (should be _____)

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 this feeder cable? If so please give details:

_____

_____

_____

FEEDER CABLE AND LOOP DETAILS

DC resistance of Feeder plus Loop: _____ ohms

Inductance of Feeder plus Loop: _____ Micro Henries

Loop and feeder resistance to earth (with detector unplugged) using a 500V Megger: _____ Ohms (should be greater than 10 Mega Ohms)

READINGS FROM DU100 DIAGNOSTICS UNIT

Frequency: _____ kHz Loop Frequency Drift: _____ %

If you do not have a DU100 when the detector tunes how many times does the green LED flash_____

Inductance Change for each type of vehicle that is encountered on this site. (Use the maximum sensitivity reading from the DU100 and reset the detector between each reading):

Bicycle: _____ %ΔL/L

Motorbike: _____ %ΔL/L

Car: _____ %ΔL/L

Articulated truck: _____ %ΔL/L

Four wheel drive: _____ %ΔL/L

5 Ton Tip Truck: _____ %ΔL/L

Forklift: _____ %ΔL/L

Other specify: type _____ Change _____ %ΔL/L

Sensitivity Min: _____ %ΔL/L Max: _____ %ΔL/L

Status (Undetect, Detect, Open circuit, Short circuit or Indeterminate):_____

Time since last retune: _____ days _____ hours

Reason for Retune (Reset: manual or power failure, Short circuit, Open circuit, Indeterminate, Inductance change of greater than 15 %ΔL/L (typical): _____

Crosstalk (Pass / Fail): _____ If fail actual frequencies of the two problem detector loops

Frequency 1:_____kHz Frequency 2:_____kHz