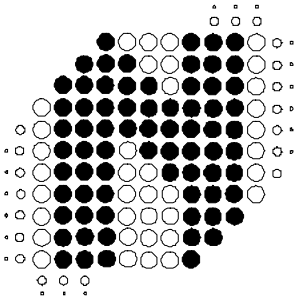
NORTECH

Nortech International (Pty) Ltd
PO Box 4099
Willowton Hub
Pietermaritzburg
3200 South Africa

32A Wiganthorpe Road
Pietermaritzburg
3201 South Africa
Reg. No. 98/1095

Tel: (033) 345 3456
Fax: (033) 394 6449
E-mail: mkt@nortech.co.za

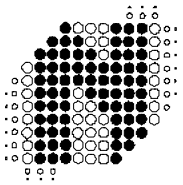
Int. Tel: +27 33 345 3456
Int Fax: +27 33 394 6449
URL: www.nortech.co.za



Track 200
USER MANUAL

Document No.: 436UM0001_04
Date of issue: November 2001

Table of Contents



WARNING: THIS UNIT MUST BE EARTHED !

WARNING: DISCONNECT POWER BEFORE WORKING ON THIS UNIT !

WARNING: INSTALLATION AND OPERATION BY SERVICE PERSONNEL ONLY !

WARNING: NO USER SERVICEABLE PARTS INSIDE. WARRANTY VOID IF COVER REMOVED!

1. INTRODUCTION

The TRACK 200 vehicle detection system allows for the detection of selected vehicles only. The equipment is suitable for a wide variety of applications, a typical example would be the identification of public transport or emergency vehicles at traffic intersections. A block diagram of the TRACK 200 concept is shown in figure 1.1 below:

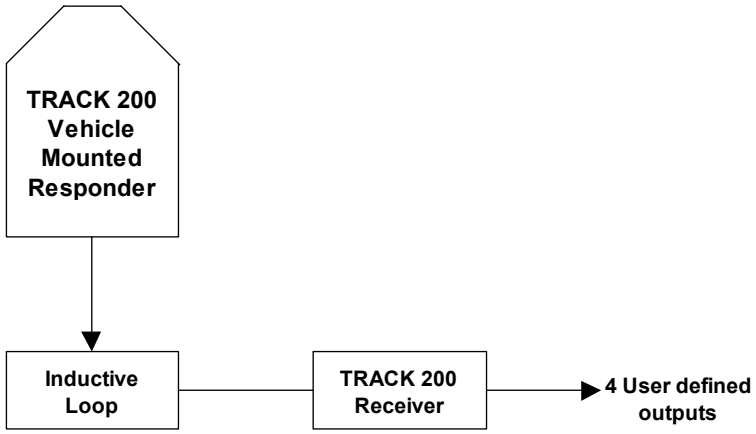


Figure 1.1 TRACK 200 Block Diagram

The system consists of TRANSMITTERS which are fixed to the vehicles to be identified, and a RECEIVEER which is connected to an inductive loop buried in the road surface. These loops are identical to those used with inductive loop vehicle detectors.

The TRANSMITTER will transmit one of four possible codes. The code that is to be transmitted is selected by a switch placed in a convenient position in the vehicle or by other automatic equipment capable of producing a contact closure. The TRANSMITTER is powered by the battery.

When the vehicle passes over the loop, the RECEIVER will detect the TRANSMITTER code, and so detect the presence of the selected vehicle.

The RECEIVER has four relay outputs, each of which correspond to one of four TRANSMITTER codes.

The TRACK 100 system utilises the same code 1 tone demodulation as the TRACK 200 system. Therefore, a TRACK 100 TRANSMITTER will activate the code 1 output of a TRACK 200 system, and a TRACK 200 TRANSMITTER set to code 1, will activate the TRACK 100 RECEIVER.

2. TECHNICAL DATA

2.1 Transmitter

2.1.1 Functional

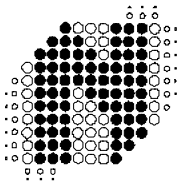
Wiring Protection	No damage will result from reversed or inter-changed leads.
Carrier Frequency	133 kHz Long term stability within 1 % of initial setting.
Method of Modulation	FM.
FM Deviation	+/- 600 Hz typical.
Coupling Method to Sensing Loop	Inductive (transformer action)
Harmonic Content (Typical) Measured on Marconi TF2370 Spectrum Analyser	2^{nd} -60dbc 3^{rd} -48dbc 4^{th} -86dbc 5^{th} -57dbc 6^{th} -<60dbc n^{th} -<60dbc
No. of Output Codes	4
Method of Coding	By individual tones Code 1 1847 Hz Code 2 1511 Hz Code 3 1279 Hz Code 4 1108 Hz
Stability of Tones	Same as RF. Oscillator. Tones derived by digital divisions of RF. oscillator.
Method of Code Selection	By external 4-way switch or contact closure
Reading Height	See table 2.1
Reading Speed	See table 2.1

Speed Versus Transmitter Height					
Sensitivity Setting	0 – 60 km/h	80 km/h	100 km/h	120 km/h	140 km/h
Minimum	0.1 – 0.8 m	0.1 – 0.8 m	0.1 – 0.8 m	0.5 – 0.8 m	-
Normal	0.1 – 1.2 m	0.1 – 1.2 m	0.1 – 1.2 m	0.1 – 1.2 m	0.5 – 1.2 m
Maximum	0.1 – 2.0 m	0.1 – 2.0 m	0.1 – 2.0 m	0.1 – 2.0 m	0.5 – 2.0 m

Table 2.1

Note:

1. Above Readings obtained at an ambient temperature of 25°C
2. All above readings were obtained using a 1.8 m x 1.8 m, 3 turn loop.



2.1.2 Electrical

Power Requirements	11 to 40 volts DC at 10 mA maximum (measured with code 1 activated)

2.1.3 Environmental

Temperature	Storage Temperature -40°C to +80°C Operating Temperature -10°C to +70°C Humidity 0% to 98% non-condensing

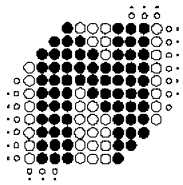
2.1.4 Mechanical

Size of Module	Cone Shaped Base of cone diameter: 85 mm Height of Cone: 87 mm
Module Material	Polypropylene. Injection moulded.
Colour	Black.
Mounting Method	By single bolt mounting at cone apex. Diameter of mounting hole: 20 mm.
Mounting Position	Beneath vehicle to a maximum height of 0.8 m above road surface (to base of cone).
Mounting Angle	Base of cone downwards. To be within 30° of horizontal.
Waterproofing	Totally sealed housing. Not affected by water spray.
Vibration and Shock	Designed to withstand the severest mechanical environment on all types of vehicles.
Method of Cable Exit	Through centre of mounting bolt.

2.2 Receiver

2.2.1 Functional

Front Panel Controls	Green LED: Power Red (detect) LED: Transmitter detection Red (code 1-4) LED: Valid code 1 Sensitivity switch. Three-step.
Operating Instructions	On self-adhesive side label on each unit.
Front Panel Markings	Control switch functions. Indicator lamp functions.
Rear Panel Markings	Serial number (self adhesive).
Side Panel Marking	Operating instructions, model type, name of manufacturer.
Serviceability	All components readily available. No special components utilised.
Receiver Frequency	133 kHz
Method of RF. Demodulation	Phase locked loop demodulator
Lightning Protection	Internal. Input transformer coupled and diode clamped.
Adjustments to Various Loops	Automatic (No tuning required).
Loop Tuning Range	10µH to 1000µH
Loop Feeder Length	Maximum 300 metres.
Recommended Feeder Type	Twisted pair cable of at least 0.5 mm square copper cross section, multi-strand.
Method of Code Recognition	By reliable phase locked loop based tone decoders.
Output Interface	Single N/O contact per code, plus common.
Relay Contact Rating	6 A 220V AC
Relay Life	Greater than 10^9 operations.
Contact Suppression	Nil
Output Method	Presence. Relay remains energised for duration of TRANSMITTER proximity to loop. Does not time out. 1 second (approximately) extension timer provided to prevent spurious outputs as TRANSMITTER traverses null points in the road inductive loop.



2.2.2 Electrical

3 – Pin VDE plug
Note: Mains cable is wired as per standard colour code.

Power Requirements	Mains voltage 220V/110V AC Mains input. Tolerance: +10% to –20% Frequency: 48 to 65 Hz Power: 2.5 VA maximum

2.2.3 Environmental

Storage Temperature	-40°C to +80°C
Operating Temperature	-10°C to +70°C
Relative Humidity	0 to 95% non-condensing. Environmental coating over completed PCB and components.
Vibration and Shock	Designed to withstand continuous vibration as experienced in a traffic controller when vibrated by traffic flow.

2.2.4 Mechanical

Mounting	Free standing unit. Can be mounted at any angle.
Connector	11-pin sub-magnal type to industry standard, mounted on rear of unit. VDE power plug.
Size of Module Housing	Height: 113 mm Width: 56 mm Length: 131 mm (excluding connector and controls)
Material of Module Housing	ABS Blend
Colour of Module	Black

3. HARDWARE

3.1 Receiver

Figure 3.1 Front view of RECEIVER

11 Pin Submagnal Connector Wiring Detail

Pin	Colour	Function	
1	-	Not used	
2	-	Not used	
3	Yellow	Code 1 Normally open relay contact	
4	Grey	Code 2 Normally open relay contact	
5	Mauve	Code 3 Normally open relay contact	
6	Pink	Code 4 Normally open relay contact	
7	Blue	Loop	Twist this pair
8	Blue	Loop	
9	-	Not used	
10	Brown	Code 1-4 Common relay contact	
11	-	Not used	

VDE Connector Wiring Detail

Colour	Function
Green/Yellow	Earth
Brown	AC Live
Blue	AC Neutral

3.2 TRANSMITTER

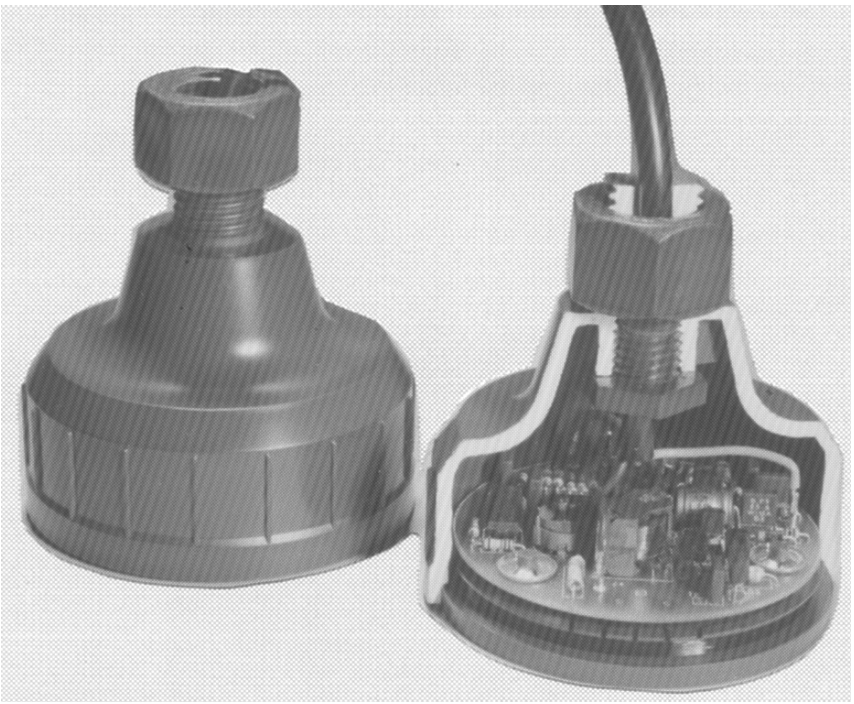


Figure 3.2 Front view of TRANSMITTER

TRANSMITTER Wiring Detail

Colour	Function
Brown	+12V
Blue	Ground
Black	Code Inputs
Green Code	Code Inputs

4. OPERATING PRINCIPLES

The TRANSMITTER antenna consists of a parallel resonant LC circuit, tuned to the fundamental carrier frequency as shown in Figure 4.1 (a). Being parallel resonant this circuit would ideally not “transmit” any power, as the losses would be zero. However, due to circuit non-linearity and losses, a minimum of RF. Power is transmitted but would be extremely difficult to measure.

The RECEIVER sensing loop consists of a large coil of wire embedded in the roadway. Therefore, transformer coupling takes place between the RECEIVER and the TRANSMITTER antenna. The RECEIVER loop is shown in Figure 4.1 (a) and (b).

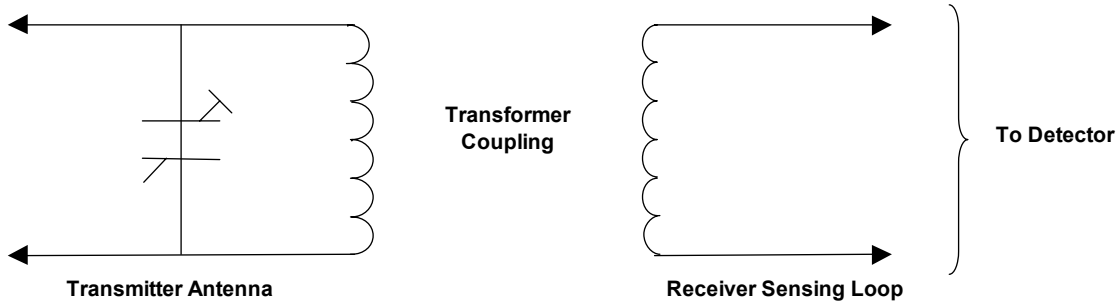


Figure 4.1 Transformer coupling

When a fitted vehicle is present over the sensing loop, the RECEIVER selectively filters out unwanted signals and amplifies the TRANSMITTER carrier signal. When the input signal exceeds a present threshold, an internal squelch gate opens and permits the received signal to be processed. This squelch threshold is important as it ensures consistent sensitivity from unit to unit. The front panel sensitivity switch adjusts the squelch threshold accordingly.

Tone filters decode the tone and cause an output relay actuation. The relay operation is of the presence type and the output persists indefinitely whilst the TRANSMITTER is present within the detection zone. Front panel LED’s indicate the status of the code output relay.

Output extension timing of approximately 1 second is incorporated to reduce the possibility of multiple output pulses as the TRANSMITTER passes through possible null areas of the road loop. Control philosophies that require a continuous output in the presence of slow moving vehicles (or vehicles stationary above the loop) must not be adopted.

An LED displays the status of the squelch circuit. Additional filtering is provided in the circuit to prevent the squelch gate opening with momentary bursts of noise.

5. CONFIGURATION AND INSTALLATION

5.1 Transmitter

5.1.1 General Description

The TRANSMITTER is a highly robust module intended for mounting beneath a vehicle. The unit is cone shaped to facilitate easy mounting. The one cone is hermetically sealed ensuring absolute watertightness, and prevents any tampering with the circuit electronics. It is not repairable.

A single mounting bolt is used, with the power cable passing through the centre of the single bolt.

The unit is designed to operate from the vehicle battery. A DC voltage in the range 11 to 40 volts is required. The current consumption depends on supply voltage but ranges typically from 6.5mA at 12 volts, to 10mA at 40 volts.

No regulation of the supply voltage is necessary, as an internal regulator removes any ripple or noise from the source.

5.1.2 Vehicle Installation

1. Choose a position which is approximately midway, breadth-wise, across the vehicle. Position as close as possible to the front of long vehicles (Buses, trams and lorries) so that if they encounter sensing loops situated at the stop line, they are detected when stationary. Refer to Figure 5.1 for suggested mounting areas of the TRANSMITTER.

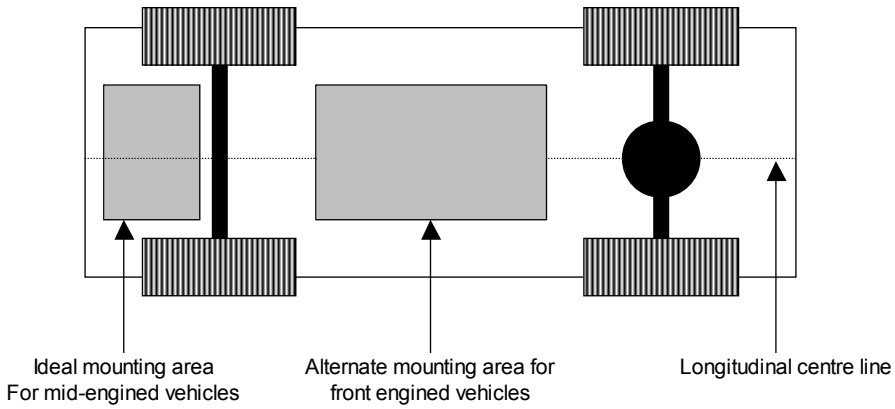


Figure 5.1 Underside view of vehicle

2. Endeavour to keep the TRANSMITTER mounting position along the centreline of the vehicle. This optimises the TRANSMITTER positioning with respect to the sensing loop. However, on electronically driven vehicles (trams etc) the TRANSMITTER must be positioned as far as possible from the traction motor and control circuitry. That is, at the front or the rear of the vehicle.

3. Mount the TRANSMITTER (cone) so that the base of the cone is horizontal to the surface of the road. Deviations of up to 30° from the horizontal are permissible.

4. Mount the TRANSMITTER so that the base is within 0.8 m of the road surface. Reading speeds are governed by sensitivity settings and TRANSMITTER mounting height.

5. Choose a protected place such that stones and similar objects displaced by wheels cannot cause any damage.

6. It is important that the unit be directly visible from beneath, that it is not positioned behind chassis members. Furthermore, a minimum clear area of 100 mm is required around the periphery of the cone base.

7. Avoid all areas beneath the vehicle which are subject to fuel and oil leaks, and accumulations.

8. Avoid hot areas such as areas adjacent to pipes, heat exchangers, engines and gearboxes.

5.1.3 Mounting on the vehicle

1. Drill a 24 mm diameter hole directly through the vehicle floorpan to accept the single mounting bolt. Alternatively, a separate bracket can be fabricated as required for attachment to the chassis or sub-frame members.

2. Feed the power cable through the mounting hole and the securing nut.

3. Using an open ended spanner, carefully tighten the nut.

4. Route the TRANSMITTER cable to a convenient point behind the instrument panel of the vehicle, where it can be attached to the code selector switch (if one is to be used) and to the vehicle's power source. Ensure that the blue, negative, lead is securely earthed to the vehicle bodywork by first removing al paint from the area and using a serrated washer in conjunction with the lug securing screw. Refer to figure 5.2 for TRANSMITTER mounting details.

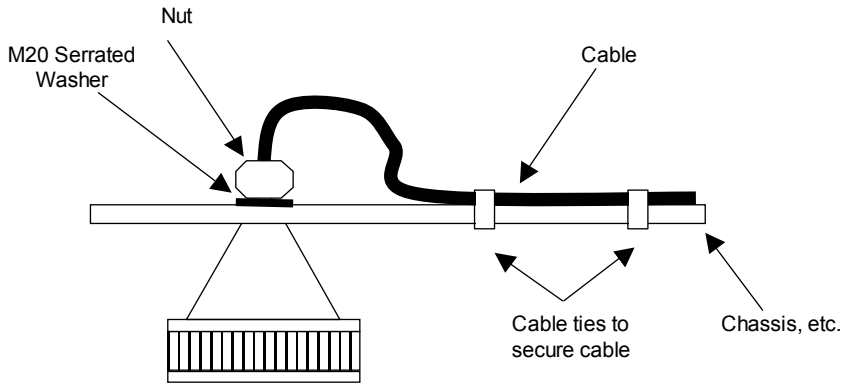


Figure 5.2 TRANSMITTER mounting details

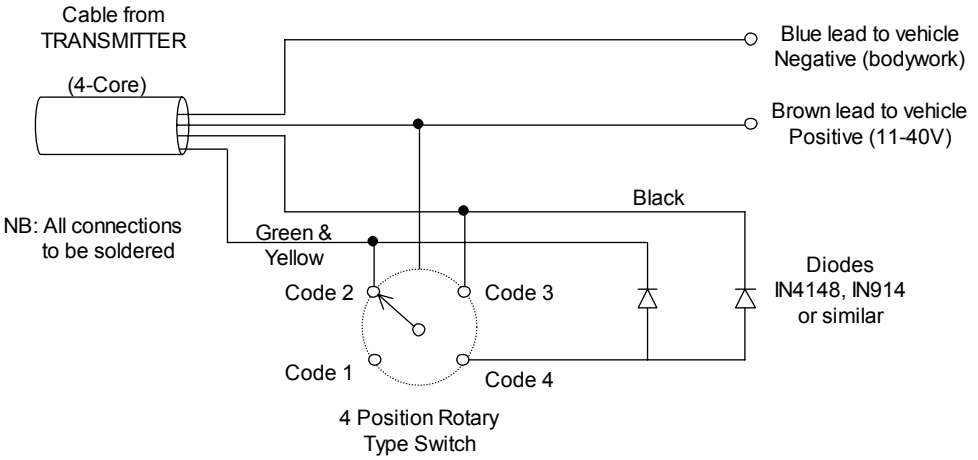


Figure 5.3 TRANSMITTER Wiring

5. Wire the vehicle's TRANSMITTER and code select switch (if fitted) as detailed in Figure 5.3.

6. Take care when routing the cable that it does not pass any sharp points on the chassis or bodywork which could chafe it. Furthermore at every point that the cable passes through the bodywork of the vehicle, ensure that a rubber grommet is used.

7. Use cable ties to secure the cable at strategic points to prevent movement and fatigue.

8. Solder all connections and extensions to the power/control cable and insulate/waterproof to standard of existing cable.

9. Liberally spray the mounting nuts and bolts and all earthing point hardware with a quality chassis type sealer/corrosion inhibitor. (Example: Valvoline "Tectyl").

10. Test the unit by driving over a RECEIVER equipped loop.

5.2 Receiver

5.2.1 General Description

The TRACK 200 RECEIVER is packaged in an ABS plastic housing. This unit is the same size as the industry standard for inductive loop vehicle detectors and has similar connectors. It may therefore be accommodated on the detector shelf of traffic control equipment or as a "stand alone" module in other control equipment. The glass-epoxy printed circuit board and components are coated with an environmental coating which prevents moisture ingress.

Special circuits are employed to reject unwanted electrical interference, and frequency modulation of the sender is used in conjunction with phase locked loop detection techniques to further enhance performance under difficult conditions.

Virtually any existing loop and feeder configuration within the inductance range of 10 to 1000 microhenries can be used. No on-site tuning adjustments are required.

Frequency constraints imposed on this type of equipment require it to operate in the same band as inductive loop vehicle detectors. The front panel "detect" LED is provided for this

purpose and will glow on receipt of a carrier. With no TRANSMITTER in the loop, indication would be caused by an external source, for example a loop detector, and is simply eliminated by altering the loop detector operating frequency.

The “detect” LED furthermore displays electrical interference as picked up by the loop, enabling the engineer to eliminate this. Mains power derived noise is normally represented by a flickering LED.

A 3-position “SENSITIVITY” switch enables the RECEIVER to be optimised to odd loop configurations.

The RECEIVER output relays are rated at 6 A 220V AC. A front panel LED displays the status of the channel.

Lightning protection is supplied as standard in the equipment, and the loop input is further isolated from the rest of the circuitry by an isolation transformer.

An integral mains power supply is included with each module obviating the necessity of separate power supplies.

The unit is supplied with an 11-pin rear mounted sub-magnal connector.

5.2.2 Commissioning procedure

NOTE: A condensed “OPERATING INSTRUCTIONS” schedule is affixed to the side of each Detector module as an aid to field personnel.

Step 1 Power up the RECEIVER and all other equipment, particularly loop detectors, in the vicinity.

Step 2 Set the “SENSITIVITY” switch to “MAXIMUM”.

Step 3 Observe that the “DETECT” LED does not glow. A continuously glowing LED indicates crosstalk from a loop detector or other source. Remedy this by isolating the particular loop detector(s) and varying their operating frequency. All modern loop detector modules have this adjustment facility.

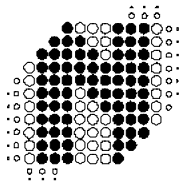
This interference must be monitored with vehicles traversing the loops, as many loop detectors feature a free running front end oscillator, the frequency of which is varied by vehicles traversing the sensing loop. Ensure that all TRANSMITTER equipped vehicles are detected.

Step 4 A flickering LED is normally indicative of mains borne interference.

Note: Momentary random flashes of the “DETECT” LED are unimportant. Special circuits within the RECEIVER cancel out electrical noise effects.

Step 5 Sensitivity is optimised for most applications with the switch set to “NORMAL”. In applications where loops are positioned in adjacent lanes, and coupled to separate RECEIVERS, it may be necessary to select “MINIMUM” sensitivity to eliminate pick-up from adjacent lane TRANSMITTER equipped vehicles.

Avoid the use of the “MAXIMUM” sensitivity setting in all but most peculiar installations involving high bed vehicles or in specialised non-vehicular applications.



Step 6 The unit is now operational and the front panel LEDs show the output relay status.

Note: The “DETECT” LED will glow whenever a TRANSMITTER is within the loop vicinity. This is normal.

5.3 Loop and Feeder Installation

The loop is installed within a narrow saw-slot cut into the road surface as is common practice for inductive loop detector sensing loops. For this application, the gauge of wire has little effect on overall performance. However, it is recommended that heavy duty insulation wire with a rating of 10 amps and over is used for the loop and feeder.

Note that the heavier the wire gauge, the greater the robustness of the loop, particularly in areas that experience large summer/winter temperature variations and road freezing.

Polyethylene is the preferred insulation material for the loop wire as PVC type insulation is both water porous and soft.

A loop width of 1 metre in the direction of traffic flow is recommended, however existing loop installations which may be considerably wider, are generally acceptable. The unit is highly tolerant to loop size variations and will operate with virtually any loop falling within the 10 to 1000 microhenry inductance range.

Loops that are to be used in conjunction with the TRACK 200 RECEIVER should be positioned so as to be at least 3 metres away from the adjacent parallel edges of traffic control loops connected to vehicle detectors.

Restrict loop length to 10 metres (3 lane span) maximum. Ensure that the minimum length is equal to the width of the TRANSMITTER equipped vehicle.

Loops of total circumference less than 6 metres should comprise 3 turns, all other loops 2 turns.

A maximum loop feeder length of 300 metres is permissible. For minimum noise pick-up ensure that the feeder is preferably of twin core screened type although in most applications unscreened twin core feeder is adequate. There is no minimum feeder length specified.

Note that all loop and feeder joints are to be soldered and insulated to meet original cable specification.

Seal all roadway slots for the loop and feeder with an epoxy type grout.

Finally, check the earth leakage DC resistance of the loop to equipment ground. At completion of a new installation this should exceed 20 Megohms, and on other existing loops should exceed 10 Megohms. Conduct this measurement with a megger type high voltage tester.