ZAP MODELS 1100 & 1102

MAGNETIC LOOP DETECTOR INSTRUCTIONS

Picture of 1100

Picture of 1102

Operation

The Magnetic Loop Vehicle Detector is used to detect the presence of a vehicle as it passes over a loop of wire, which has been set into the ground. Oscillations are produced in the loop by the detector, the frequency of which depends upon the inductance of the loop. As a large piece of metal passes over the loop it's inductance changes and so, therefore, does the frequency. The detector senses this change, then it gives an output.

The Loop Detector can be used for the following applications:-

- As a safety sensor, to prevent a door from closing onto a vehicle.
- To signal a door to open.
- As a vehicle sensor for a car park ticket machine.
- To give a car park barrier a close signal after a vehicle has passed through.

Other uses include general vehicle detection and counting

Output Signals

There are two sets of outputs from the controller, PRESENCE and PULSE. These outputs are Volt-Free Normally Open (N/O) & Normally Closed (N/C) pairs. The Pulse relay can be set to give a pulse on detection of a vehicle or a pulse after the loop has been vacated. Details of the operation of the relays is outline below:

- Presence Operation:
  The relay is NORMALLY ENERGISED (fail-safe) and will de-energise on detection of a vehicle. The Relay will re-energise 0.8 seconds after the loop has been vacated.
- Pulse-On-Detect Operation (Switch 6 **OFF**):
  The relay is NORMALLY DE-ENERGISED. It will energise on detection of a vehicle and de-energise 1.0 second later - even with a vehicle still present upon the loop.
- Pulse-On-Exit Operation (Switch 6 **ON**):
  The relay is NORMALLY DE-ENERGISED. It will energise for 1.0 second, 0.8 seconds after the vehicle has vacated the loop area.

Installation

The detector should be mounted as close to the loop as possible and in a weatherproof enclosure. The 1100 series unit should be preferable mounted on a DIN-Rail, the 1102 series module plugs onto a receptor on a relevant ZAP Controller.

Reinforcing

The existence of reinforcing steel below the road surface has the effect of reducing the inductance, and hence lowers the sensitivity of the detection system. In this case **2 addition turns** should be added to the loop. The ideal spacing between the loop and reinforcing is 150mm, although this is not always possible. The slot depth should be kept as shallow as possible taking care that no part of the loop be exposed after the sealing compound has been applied.

Loop Installation

A slot must be cut for the loop and feeder wire. The slot should be cut with a masonry-cutting disc or similar. A 45° crosscut should be made to the corners to prevent the risk of damage to the cable at 90° bends. A slot must also be cut for the feeder, from the loop circumference the location of the loop detector. The slot should be of the following dimensions:-

SLOT WIDTH:	4mm
SLOT DEPTH:	30mm to 50mm

Single core insulated wire should be used for the loop and feeder and should have a cross-sectional area of at least 1.5mm^2. The loop 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 has been laid into the slot circumference, a similar tail is then routed back along the feeder slot to the detector. The feeder tails should be twisted together, with at least **20 turns per metre**, all of the way to the detector. Extra length should be left on the tails to allow for the twists. It should be noted that the detector sensitivity will decrease as the feeder length increases and so, for this reason, the feeder should be kept as short as possible, and less than 100 metres. Screened cable should be used for long feeders, with the screen earthed at the detector end only. Also, the feeder and loop should have no joins. If it is necessary to join cables then the joints should be soldered and terminated in a waterproof junction box.

When two loop configurations are in close proximity, the magnetic field of one can overlap and disturb the field of the other; this phenomenon is known as *Crosstalk* and can cause false detections and lock-up. The following can eliminate crosstalk:

- Careful choice of operating frequency. The closer together the two loops, the further apart the frequencies of operation must be.
- Separation of adjacent loops. Where possible a minimum spacing of 2 metres should be kept between loops.
- Careful screening of feeder cables. If they are routed together, or with electrical cables, screening should be earthed at the detector end only.

Loop Dimensions

Ideally, sensing loops should be rectangular with the longest sides at right angles to the direction of travel. These sides should be 1 metre apart. The table below gives a guide of the number of turns required for various loops sizes: It should be aimed to obtain a loop frequency of between 22 kHz and 38 kHz. The frequency can be checked using the diagnostic mode of the controller (see Diagnostic Mode section). It is prudent to lay an extra turn on the loop and connect it to the controller prior to twisting the feeder; in this way the frequency can be checked and increased, if need be, by removing a turn. In short, to tweak the loop frequency:

To Increase Loop Frequency:	Remove Loop Turn
To Decrease Loop Frequency:	Add Loop Turn

LOOP CIRCUMFERENCE (IN METRES)	WITHOUT METAL REINFORCING	WITH METAL REINFORCING
4	7	9
5	7	9
6	6	8
7	6	8
8	5	7
9	5	7
10	4	6
15	3	5
20	3	5

Wiring Connections

All wiring for the power supply and relay connections should be kept clear of the feeder.

A 24V a.c. or d.c. supply (28V MAX) must be connected to the 24V terminals of the 1100 controller; the 1102 model takes it's supply directly from the mother boards receptor once it is plugged in.

All of the controller's relay outputs are labeled N/O and N/C and describe the output states whilst the loop is unoccupied. Connect for Normally Open or Closed circuit as required. If a loop is to be used as a safety device then the presence N/C connections should be wired in series with the SAFETY input terminals of the control unit.

Setting-Up

As the Loop Controller powers up for the first time, it will indicate information about it's various setup modes, via the red and green LED's of each channel. These modes, and the information, are detailed below.

Diagnostic Mode

During this mode the loop performance is analised. The information given will be:

1. Frequency Display: The frequency will be displayed TWICE by each channel using the Green LED's; each LED will give a series of long flashes to indicate 10's of kHz, then short flashes to indicate 1's of kHz. For example, 32 kHz would be displayed by 3 long flashes followed by 2 short flashes; this would then be repeated.
2. Calibration: While the controller monitors the loop to ensure that the frequency has settled and is stable, the red and green LED's will cycle.
3. Frequency Display: Again the frequency will de displayed twice, using the same format as for point '1' above.

Note: If a series of rapid bursts are observed form the green LED, this is an indication that the loop frequency is either too high, too low, open circuit or the inductance of the loop is short circuit.

Frequency Settings

If the frequencies of two adjacent loops are within 2kHz of one another, then switches 1, 2 or both should be set to ON; this should be only be done for the channel having the lower frequency. By this way the frequency of one loop will be reduced and thus crosstalk will be prevented. The controller should then be isolated for 10 seconds and then re-powered; again follow Diagnostic Mode steps 1 to 3.

Sensitivity Setting

Once the loop has stabilised and the diagnostic mode is complete, the red and green LED's will pole on and off together. This is an invited for a typical vehicle to be placed upon the loop so that the sensitivity can be set. While the sample vehicle is on the loop the red LED will remain illuminated (it will become extinguished if the loop is vacated) and the sensitivity setting will be displayed via the green LED. The green LED will give a burst of flashes (1, 2 or three flashes per burst depending upon the sensitivity) and these bursts will continue until the sensitivity switches are set. The corresponding settings for the LED pulse bursts are detailed in the table below:

SENSITIVITY	FLASHES	SWITCH 3	SWITCH 4
LOW	3	OFF	ON
MEDIUM	2	ON	OFF
HIGH	1	ON	ON

Safety & Pulse Mode Settings

- Safety (Switch 5) defines how the controller's Presence relay will react in the event of a loop failure. With Sw 5 OFF, the presence relay will activate to give a safety breach (fail safe), this state will remain until the loop is repaired. With Sw 5 ON, the Presence relay will remain in-active and is ideal for applications such as car park barriers.
- Pulse Mode (Switch 6) has a different function for Loop 1 and Loop 2. For Loop 1, with Sw 6 OFF the output relay will give a PRESENCE operation; with Sw 6 ON the output relay will give a Pulse-On-Detect operation. For Loop 2, with Sw 6 OFF the output relay will give a Pulse-On-Detect operation; with Sw 6 ON the output relay will give a Pulse-On-Exit operation.

Switch Settings

Below is an overview of the DIP Switches and their functions:

DIP-SWITCH SETTINGS		
LOOP 1	SWITCH	LOOP 2
LOOP FREQUENCY	1	LOOP FREQUENCY
LOOP FREQUENCY	2	LOOP FREQUENCY
SENSITIVITY	3	SENSITIVITY
SENSITIVITY	4	SENSITIVITY
SAFETY MODE	5	SAFETY MODE
PRESENCE/PULSE	6	PULSE MODE

Further Notes For 1102 Plug-In Module

This module is designed for used with other ZAP door controllers (specifically 3300 and 8000 series controllers) and simply plugs onto one of the two receptors provided on these mother boards. The receptors are labeled 'LOOP 1' and 'LOOP 2' and in the event of only one 1102 being utilised, it is unimportant which receptor the module is plugged onto . Although Volt-Free contacts are provided for Presence and Pulse outputs, if the module is required to give an Auto-Open or Auto-Close operation no wiring need be made other than the loop terminations. All communication between the module and door controller is carried out via the module receptor. The mode of operation that the module will perform for the door controller is configured via a second set of DIP-Switches (these are described in the table below). If the module is required to give a safety operation, then the Presence N/C connections, from the terminal block, should be wired in series with the main door controllers Safety inputs. For example:

- If the module is being used to give an Open signal as a vehicle approaches the loop, then switch 1 should be set to ON (Presence Open). This will open the door on detection of a vehicle, and keep the door open whilst the loop is occupied.
- To configure the module the close a door once a vehicle has passed, then switch 4 should be set to ON (Pulse Close); switch 6, of the first bank of switches should also be set to ON (Pulse-On-Exit as described in the section 'Safety & Pulse Mode Settings' above). This will cause the door to close 0.8 seconds after the loop has been vacated.

The operation of the module is configured as follows:

SWITCH	FUNCTION
1	PRESENCE OPEN
2	PRESENCE CLOSE
3	PULSE OPEN
4	PULSE CLOSE
5	NOT USED
6	NOT USED