Tips for installing safe and reliable ground loops

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Ah, the ground loop: so simple in principle and yet oftentimes so difficult in execution. When Maxwell and Faraday conducted their groundbreaking work in the fields of induction and magnetism, they probably never anticipated the number of onsite headaches their theorems would be causing more than a century later. Otherwise they would possibly rather have applied their considerable talents to the liberal arts.

Yes, installing ground loops can be tricky but with just a little bit of know-how it is easy to install inductive loops that are safe, reliable and will not have centre management returning to a site time and again. With the aim of seamless installation in mind, here is a brief look at the mechanism of action behind the working of inductive loops.

Loops as used in vehicle access applications are generally constructed from a square or rectangle of insulated conducting material and installed underground, typically in the vicinity of a traffic barrier or other vehicle access control device. The loop is then connected to an electronic detector which transmits energy into it, basically turning it into a tuned circuit. When a vehicle or other metallic object then passes over or stops on it, the inductance in the wires is reduced which in turn results in the detector activating, typically energising a relay and triggering the co-installed barrier or access control device.

At least, that is what is supposed to happen if the planets are aligned and the loop was installed properly, which is sadly not always the case.

So, without further ado, below are nine guidelines for completing a successful loop installation:

1. Use the correct material

It is recommended that both the loop and the feeder wire are constructed from cross-linked polyethylene (or XLPE as it is more commonly known) insulated copper wire with a minimal cross-sectional area of 1,5 mm². This sort of cable has been found to be ideal for ground loops as the copper wire provides excellent conductivity while the XLPE insulation possesses considerable dielectric properties and has high heat resistance.

2. Remember to twist the feeder

The feeder should be twisted at a rate of at least 20 turns per metre to improve reliability. The reason for this is that electrical noise might be generated by the loop wire, resulting in erratic operation. Transposing the feeder wire helps eliminate or at least alleviate interference.

3. Avoid making joints in the cable

Joints in the wire are not recommended and may lead to intermittent continuity, but where required must be soldered and made waterproof.

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4. Get the size and shape right

The loop should be either square or rectangular in shape with a minimum distance of 1 m between opposite sides.

5. Turn the loop wire

Two to six turns of wire are typically used. The table below denotes the number of turns for corresponding loop perimeter:

Loop perimeter	Number of turns
3 – 4	6
4 – 6	5
6 – 10	4
10 – 20	3
>20	2

6. Use different number of turns

When two loops are laid in close proximity to each other, it is recommended that different numbers of turns are used in each loop to prevent cross-talk. Cross-talk describes the interference between two adjacent loops, and can cause reliability issues.

7. Space adjacent loops at least two metres apart

To minimise cross-talk, adjacent loops should be at least two metres apart, and on different frequency settings.

8. Enclose the loop in conduit

The most reliable form of loop is preformed and enclosed in conduit. This prevents water ingress, and minimises the effects of vibration. Where a preformed loop is not practical, slots should be cut into the road using a masonry cutting tool. A 45° cut should be made across the corners to prevent damage to the wire on the corners. The slot should be about 4 mm wide and 30 mm deep. Remember to extend the slot from one of the corners to the roadside to accommodate the feeder. After the loop and feeder wires have been placed in the slot, the slot must be filled with an epoxy compound or bitumen filler.

Last but not least:

9. Use a reliable loop detector

Even built up to the nth degree, a loop is still just wire that has been twisted and lain out in the shape of a rectangle, and an electronic detector provides the intelligence needed for the loop to work reliably in a vehicle access application.

The Centurion Flux range of highly sensitive standalone and plug-in inductive vehicle loop detectors offer a number of benefits to help installers get a loop installation up and running in the minimum of time, these include:

- Very fast detection speed for quick response times
- Detection filter and high-level circuit and loop protection provides excellent immunity to interference from external sources for improved reliability
- Easy to install and commission saving time and money
- Audible and visual diagnostics for ease of setup and maintenance
- Removable terminals for quick and easy maintenance
- Boot-loader interface for ease of firmware upgrades
- Dedicated reset button to assist with quick maintenance procedures
- Wide, adaptive self-tuning range for outstanding reliability
- Excellent, strong loop field strength for reliable operation
- Automatic Sensitivity Boost feature which boosts the sensitivity automatically for the reliable detection of variable height vehicles

Bonus tip

While loops are typically used together with traffic barriers, there is absolutely nothing stopping centre management from installing a free-exit or closing loop alongside a sliding gate. The question then becomes, "how do you stop the gate from interfering with the loop?"

As they often say in those fluff pieces at the end of the news: the answer may surprise you.

With loops generally being rectangular in shape, all that is necessary for it to work seamlessly alongside a slider is to rotate it so that it adopts the shape of a diamond or "rhombus" with one apex (ie the point where two equal length sides meet) positioned closest to the rail.