

Training update: Loops and Twisted lead-in

By Brian Dickson

An inductance loop is not a complex piece of electronics, it's just a piece of copper wire in the ground, yet there is still a lot of confusion about how a loop works and how they should be designed. The technique of installing a loop is often passed down from generation to generation. Each year advances are made in the industry, but only a handful of installers adopt them into their techniques. This often results in the same speculations/myths those instructors had, which were passed down from installer to installer thus creating the confusion we have today. By reading the rest of this training update you will have a clear understanding what's wrong with the myth of twisted loop lead-in wire and "magnetic" loop detection.

The belief that loop lead-in wire heading back to the operator for gate installations must be twisted to prevent false detections or cross-talk is incorrect. The confusion comes from loops being used with traffic signals following the IMSA spec No. 50-2-84 lead-in wire, where it is required to twist and shield the lead-ins for transmission cables. The transmission cable is the wires from the pull box to control box that often runs over 200ft. The pull box is where all the loops' lead-in join together to the transmission cables, there are usually 4 pull boxes per installation that can have 5-15 loops run in one conduit leading to the control box. The reason why the IMSA spec was written was to solve the problem of cross-talk between those 5-15+ loops running through such long distances in the same conduit. The spec details the use of a special twisted, jacketed, and shielded wire for loop lead-ins to be connected then run from the pull box to the control box. The spec says nothing about loop lead-ins leading from the loop to the pull box.

There was a study commissioned by the U.S. Department of Federal Highway Administration and Texas Department of Transportation to test cross-talk. The results, "found no indication of false detections (due to cross-talk) over either twisted or untwisted lead wires at all sensitivity settings."* In gate installations 2-4 loops are installed and where the lead-ins join together the distance to the operator is only a distance of 2 ft or less, too little of a distance for cross-talk to have any major effect. Gate installations do not use pull boxes so the above IMSA spec does not even apply to our industry. If lead-ins are ever run together over a distance of 2ft, it is recommended to keep the lead-in at least 2 inches apart from each other.

It is recommended that if you wrap your own loops with 18AWG and larger and don't use backer-rod that the lead-in wires be twisted 6 turns per foot, to prevent false detections from ground vibrations. Cross-talk can be reduced by using different frequencies in the detector. The reason why you twist your lead-in wires is so that the wires will not move. Wires that move even slightly can trip the detector causing phantom detections resulting in repeat service calls. Ground vibrations caused by cars, trains, horses, or even the gate itself can cause loose wires to move. This also applies to lead-ins leaving the saw-cut groove, they should be either twisted or jacketed to prevent movement.

The advantages of not twisting your lead-in wires will result in decreased installation time, you will not have to cut a wider saw-cut groove or spend time manually twisting the wires, and use less wire since wire when twisted is shorter. Twisted wires have a higher chance of becoming nicked while being inserted into the saw-cut groove because the wires are stretched (have greater tension). Instead of twisting lead-in wires you can use jacketed lead-in wire. Using jacketed wire not only prevents movement but adds extra protection against nicks which could cause the wire to short. Understanding how a loop works will strengthen your knowledge about twisted lead-ins and add clarity to the other myth that loops detect through magnetism.

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When a detector energizes a loop with an AC current the size of the loop, the number of windings in the loop, length of lead-in wire, and wire gauge will determine the total resistance or inductance of the loop circuit. The detector will record how much current is flowing through the loop and set that amount as the reference point. When a metal object enters the Electric Magnetic Field (EMF) field created by the loop's AC current, the metal object absorbs some of the collapsing EMF fields. Now that some of the collapsing EMF field is absorbed, it lowers the resistance (inductance) of the loop circuit. This causes a decrease in inductance through the wire that is detected by the detector. When this happens, the detector will either open or close a relay switch that activates a preset command in the gate operator such as open, close, hold, or reverse.

The myth that loops detect magnetism has a strong following. Loops detect inductance as described above. It's easy to see how this myth became so common, especially since exit probes work off of magnetic north and loops create EMF (Electric Magnetic Field) fields. However the idea that loops detect only magnetic metals is easily disproved with aluminum. This causes a lot of confusion with installers who install aluminum gates under the assumption that the loops will not detect the gate since aluminum is not magnetic. Aluminum is a non-ferrous metal (does not contain iron), but aluminum conducts electricity which can trip the detector through inductance. This obviously causes the gate to malfunction and the installer having trouble pinpointing the issue. If this mistake remains undiscovered upon completion of the installation, the customer will most certainly call and complain that their gate continually stays open resulting in a repeat service call.

Brian Dickson is the General Manager of BD Loops, a manufacturer of preformed direct burial and saw-cut inductance loops for the gate industry for more than nine years. BD Loops has over 200,000 loops installed with only one loop failure, and is available through 130 distributors nationally. The company has several letters of recommendation testifying their professionalism and design, and is a member of the following associations: AFA, IDA, NOMMA and IMSA. Visit BD Loops at www.bdloops.com and use the distributor locator tool to find a distributor near you. Call BD Loops at 714.890.1604 or email at BDLoops@aol.com

**reference*

Victor Bhagat and Donald L. Woods, P.E., *NTIS document* PB95216610 – Induction Loop Detector Systems Crosstalk, U.S. Department of Commerce, Aug 1994

This report is available on line from U.S. Department of commerce Research Report 1392-2.