MultiLoop™ Phased Array Systems

AMPETRONIC

An induction loop phased array system provides a solution where a simple loop around the room perimeter will not work. Arrays are the standard solution for buildings with metal structure or reinforcements, or for covering large areas. Arrays can also dramatically decrease the 'spill' of the magnetic signal outside of the room, allowing induction loops to be installed in adjacent rooms, and providing an improved level of confidentiality. Arrays can also be used to change the way two loops interfere with each other, providing ways of solving even the most complex installation problems. Used for:

Areas with metal structures:

- **Metal tiled flooring**
- **Reinforced concrete floors**
- **Metal suspended ceilings**
- **Retractable seating**

Large systems e.g.:

- **Airport terminals**
- **Shopping centres**
- **Exhibition halls**
- **Theatres**

Reducing spill in:

- **Boardrooms**
- **Council chambers**
- **Classrooms / lecture halls**
- **Courtrooms**

What are the advantages of an Ampetronic MultiLoop™ Phased Array System?

- **Even field strength and frequency response in the presence of metal structures**
- **Even field strength over very large areas**
- **Can reduce spill to 1-2m from the loop edge for adjacent rooms or confidentiality**
- **Minimises interactions between complex systems such as theatres with balconies**
- **Compact form can reduce rack space requirements by up to 90% on competitive solutions**

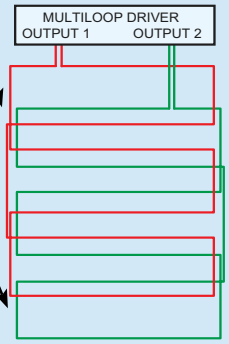
What is a Phased Array System?

A Phased Array System consists of two different conductive arrays of cable arranged in a pattern, with the two arrays running the same signal but phase shifted by 90 degrees. This prevents interaction between the two magnetic field patterns allowing creation of very even field coverage with a good loop design.

An Ampetronic MultiLoop™ Phased Array System comprises:

- A MultiLoop™ driver (amplifier)
- An array layout design
- Two arrays of cable or conductive tape

MultiLoop™ driver options are shown in the picture above, and a schematic for an array system is shown on the right.



Uses for a Phased Array System

1. Compensating for metal structures

Metal present in a building's structure affects an induction loop magnetic field in three ways:

- **Reduced signal strength**
- **Poor frequency response, causing loss of higher frequencies**
- **Variation in field strength and frequency response over the area**

The larger the loop, the greater the effect. Perimeter loops can suffer dramatic loss of signal strength, and high frequencies can be lost all together, resulting in a total loss of intelligibility. Even with a mild loss, intelligibility can be poor and often a low signal 'hole' is found in the middle of the loop area.

These issues are all corrected by use of an Ampetronic Array System. The narrow loops in the array are much less susceptible to the effects of metal. The phase shift allows two arrays to be superimposed achieving even field strength. Metal losses are hard to predict. For certainty, we recommend a site survey which you can carry out following our instructions, or we can carry out on your behalf.

Magnetic field patterns from perimeter loops and phased arrays

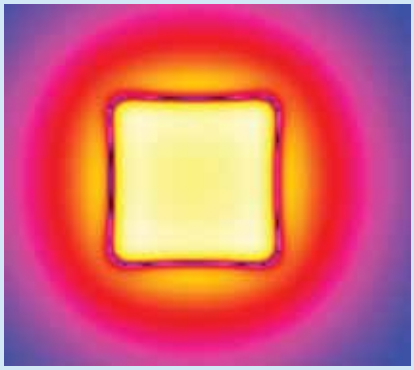


Figure 1: the pattern of spill from a square perimeter loop with no metal loss (yellow = good signal, black =<-40dB). Field spills over 3 times the loop width.

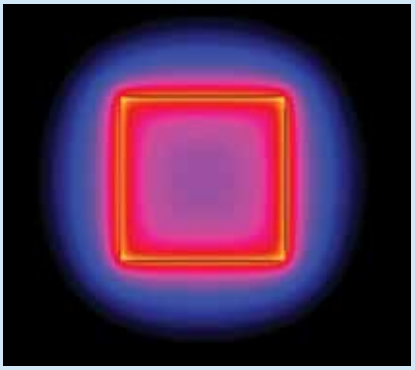


Figure 2: a typical pattern for a perimeter loop with metal loss, with a low signal ‘hole’ in the centre of the loop. This is similar to the pattern for a very large area perimeter loop.

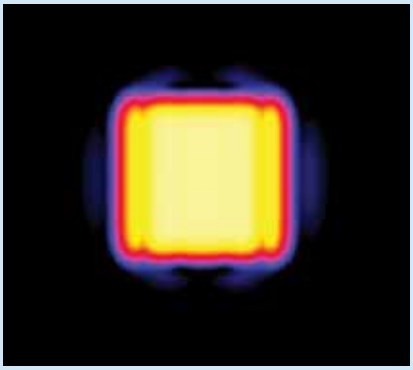


Figure 3: the same area - with metal present - using an Array System. Spill is very well controlled and the signal is even across the loop area.

2. Controlling spill

A perimeter loop 'spills' magnetic field outside of the loop area by 3 or more times the loop width and similar above and below the loop. If systems are to be used independently in adjacent spaces, or if confidential discussions are taking place this 'spill' must be reduced.

Ampetronic Array Systems all exhibit much lower spill than a perimeter loop. Ampetronic can also provide designs for an ‘Ultra-Low Spill’ system, a special layout which controls the field with great precision. Ultra-Low Spill designs can reduced horizontal spill by 40dB within 1.5m of the loop edge. Ampetronic's sophisticated design software accurately predicts system performance.

3. Interfering loops, large systems etc.

There are many other environments where Array Systems can provide a benefit, such as providing even coverage over very large coverage areas, or preventing interactions between loops such as between loops in the stalls and in the balcony of a theatre. An Array System gives the designer much greater control over field distribution, allowing standard-compliant performance in the most difficult installation environments.

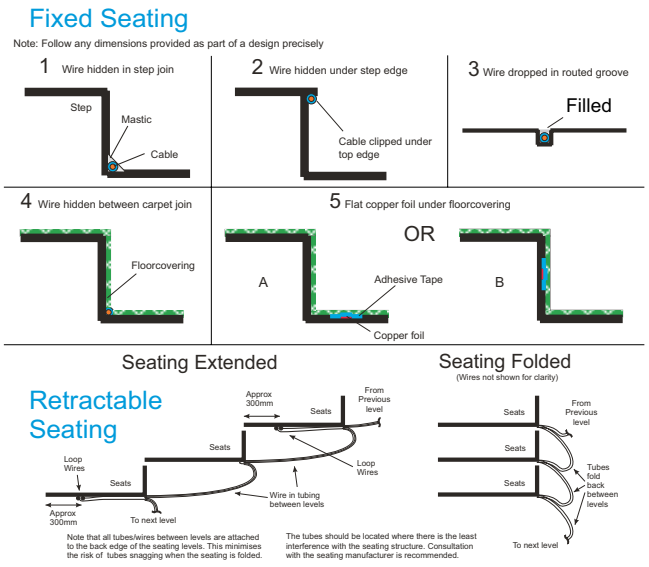
Cable Installation

Array Systems usually require installation across, within or under the floor surface, or within a ceiling void. It is important to identify the best location for the installation before completing a loop design.
Ampetronic recommends three types of cable for the loop arrays:

Tri-rated copper cable
Suitable for running along skirting boards, inside conduit, ceiling cavities or behind cosmetic features. Gauges commonly used are 1.0 to 2.5mm2.

Copper foil tape (FB1.8)
Very flat tape designed for running underneath floor coverings e.g. carpet. Very low impedance is ideal for long cable runs and gets more from the amplifier.
Supplied by Ampetronic, including plastic conduit and warning tape for installation.

Direct burial cable (DBC)
Specialist cable resistant to degradation from concrete - suitable for direct burial in screed, underground and outside use.
Supplied by Ampetronic.



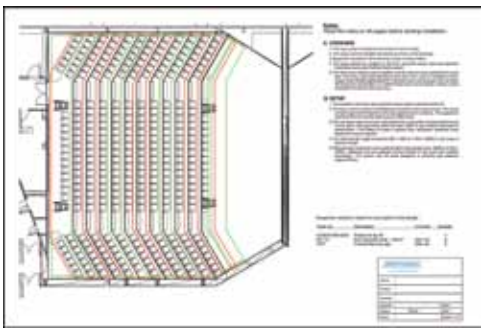
Ampetronic Loop designs for Phased Array Systems

To purchase and use an Array System you must have a suitable loop layout design for the two cable arrays. If you provide a design, Ampetronic will check it for free, otherwise Ampetronic or your distributor can supply a design for a nominal charge.

You can carry out your own loop design following Ampetronic guidance (please ask for our loop design guidance notes).

An array needs a loop design specific to the area to be installed. It is very important that this loop design takes into consideration: The intended use of the system

- **Structural metalwork near to the system**
- **Requirements for low spill performance**
- **Dimensions and layout of the area**
- **Location for installation of the loop cables**



Above: Sample of a general layout drawing from a typical Ampetronic design, with extensive installation notes and detailed layout information

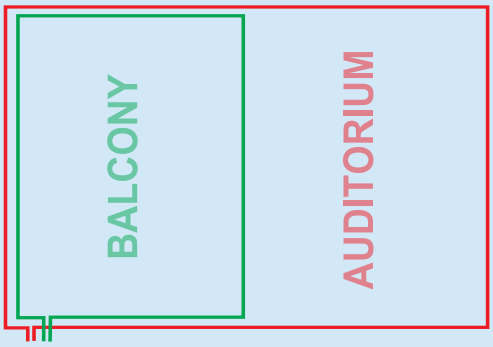
MultiLoop™ System Design Configuration Examples

MultiLoop Drivers can be used for different types of loop layout. You will need a MultiLoop system design for the loop layout which you can obtain from Ampetronic, or have your own design approved by Ampetronic free of charge.

Perimeter MultiLoops

Two channels drive single area loops either side by side or overlaid.

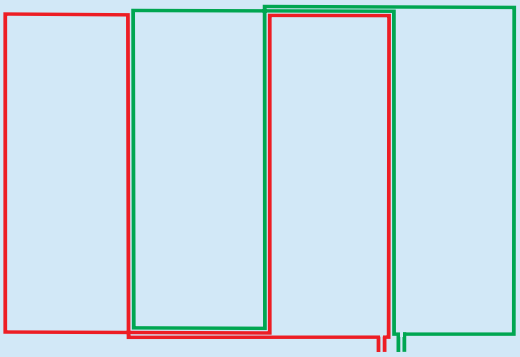
Suitable for applications where there is no metal in the buildings construction, or in areas of moderate metal up to a maximum loop width of 5 meters.



Simple MultiLoops

Parallel loop segments with adjacent cables for ease of installation. Does not give the even coverage of loss control or low spill loops, with dips in level between loops.

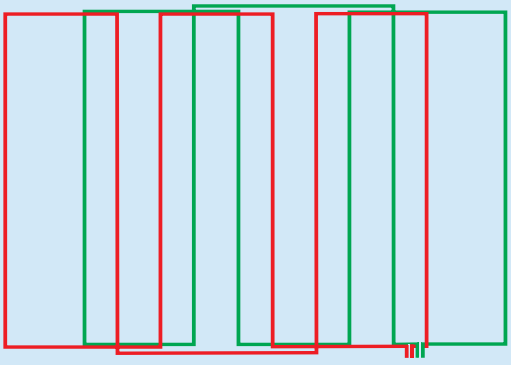
Suitable for fixed seating areas, or where dips in field strength are acceptable.



Loss Control MultiLoops

Multiple loop segments in two patterns each driven by one out put channel.

Best for optimum even area coverage across any area. Suitable for large areas and buildings with metal construction.



Low Spill MultiLoops

Similar in design to Low Loss MultiLoop but with a more complex pattern that requires more cable.

Suitable for applications where loops are close together or where confidentiality is an issue. Low Spill MultiLoops require careful and precise design.