Hearing Loops
A Guide to Best Practice

AMPETRONIC

Listen to the difference

Nissan Yellow cabs, NYC, USA


Eiffel Tower, Paris, France


Queens University, Belfast, Ireland


Stonehenge, Wiltshire, UK


St Pauls Cathedral, London, UK

Why Hearing Loops?

Every day millions of hearing aid users utilise Assitive Listening Devices to access equal auditory information within airports, lecture halls, theatres, points of sales and anywhere they are required to access audio services.

Despite digital advancements modern hearing aids are still primarily designed for 1 to 1 communications over short distances, making the separation of environmental background noise in busy environments from the sound that the user wishes to hear difficult or impossible, with any distance to the sound source, such as a speaker, exacerbating the problem.

To enable people with hearing loss to have an equal experience, it is essential that they are provided with equal access to the same information and communication as hearing people. For example arrival and departure broadcasts or point of sales areas need to assist those with an auditory disability.

Statistics from around the world reveal that approximately 15% of the population experience some form of hearing loss, and that around 1 in 4 of those people will be using hearing aids. This significant section of our society is protected by anti-discrimination legislation (varies dependent on each country) which requires service providers to make reasonable adjustments to their services to cater for them using 'Assistive Listening' technology.

The only suitable Assistive Listening technology that is transient and doesn't require the handing out of receivers, is a Hearing Loop - as Hearing Loops function by connecting directly to the users own receiver, their hearing aid.

Facility operators can find themselves in an actionable position if there is no service provision that is of a genuine benefit to those with hearing loss. The measurable performance of a Hearing Loop is defined in the IEC 60118-4 Standard, so it is imperative that a well-designed and fully functional system is installed.

About Ampetronic Hearing Loops

Established in 1987, Ampetronic are innovators in the full range of induction loop / hearing loop systems and technologies, working as specialists in the field for 25 years. Passionate advocates for technology solutions that improve the lives of those with hearing loss, we design, manufacture and promote loop systems around the world

The business was founded by Leon Pieters, a highly skilled engineer and local preacher. Seeing the need to communicate the spoken word to those in his church community he set to work on developing high quality loop technologies, systems that really made a difference.

Ampetronic has continued to innovate throughout its history, bringing to market key new technologies in current drive, phase shift arrays, measurement systems, software analysis and other key technologies.

The business' head office is based in Newark, Nottinghamshire and not only comprises the sales, marketing, distribution and R&D departments, but also the worlds largest dedicated induction loop technical support and design team - who provide a comprehensive service to all our clients. Our customers are active all around the globe, with many regional distributors and agents.

We have been consistent and passionate advocates for assistive listening around the world, contributing to development of standards, legislation and best practice in many countries. Building on the experiences of the formation of the UK market, both good and bad, we strongly advocate for best practice from day one in any country.

We believe that if it will not help, don't do it! Too many companies will sell boxes to customers that want to tick a compliance box, but in effect provide no benefit at all to the end user. We believe strongly that we are responsible for the reputation of loop systems, and will protect this by only selling where we believe the systems are put to appropriate use.

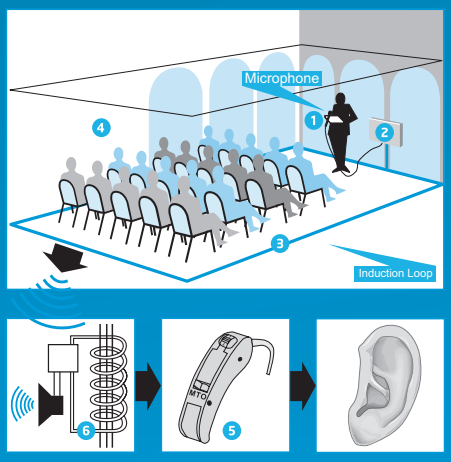
Loops can be simple, but also simple to get wrong. Far too many systems fail around the world through lack of basic knowledge and training.
We choose not to invest heavily in sales and marketing, but to invest in education at every level of the chain.

Hearing Loop technology has existed for decades and is relatively simple in its most basic form. It is however very easy to incorrectly specify a system type and components for specific applications, or to make errors when installing the system. Both of which can result in a system that does not provide a beneficial experience for its users, or meet the requirements of the internationally recognised Standard for Hearing Loop performance (IEC 60118-4).

Any person intending to specify, design or install a Hearing Loop should know the requirements of the **IEC 60118-4** Standard relating to; field strength, frequency response, background noise and subjective testing. **Remember: If it's not working to the requirements of IEC 60118-4 then it's not working properly!**

Copies of the Standard are available from the British Standard Institute website and training is available from reputable Hearing Loop manufacturers and the Institute of Sound & Communication Engineers (UK Only).

The following diagram explains the principle of how a simple perimeter hearing loop functions.



Hearing Loop System - Key Requirements

1. Increases signal to noise ratio

The system must greatly improve upon the signal to noise ratio that can be achieved with a standard hearing aid or cochlear implant that is not connected to a hearing loop.

Examine the input source(s) and select an amplifier and adaptors to suite.

- If using microphone(s) as an audio source - microphone type and placement is crucial
- Do not use omnidirectional microphones (especially in ceiling tiles) for area coverage applications, as it will generally only achieve as good an effect as the microphone in the user's hearing aid, if not worse.

2. Provides suitable area coverage for the application

Determine what the use, or uses, of the space in which a proposed installation will be.

- If the space contains fixed seating the listening height will be approximately 1.2 meters, the systems loop design and amplifier power requirement must accommodate this.
- If the people using the loop system are free to stand and move around in the space then the listening height will be approximately 1.6 meters. This scenario also precludes the use of Simple Single Phase Array loop designs (figure of 8 etc) which leave 'dead spots'.
- If the area contains a staged entertainment area where microphones and electrical instruments will be used then a Cancellation Loop or Low Spill Multi Loop Phased Array loop design is required to prevent the signal interacting with on-stage equipment.
- As much of the available space as possible should always be looped. Providing a small looped area for hearing aid users is not acceptable as this is likely to separate users from their friends and family, which is discriminatory.

3. Is not susceptible to interference from background noise

Electromagnetic Noise can be created by faulty wiring and local substations. It can affect intelligibility and provide an uncomfortable listening experience.

- Check how much electromagnetic noise is experienced in the looped area using a suitable meter. Must be less than or equal to -32dB (A-weighted).
- Where possible, noise should be addressed at its source, such as fixing faulty wiring or ground loops.

4. Generates the correct field strength

A Hearing Loop system functions by producing an alternating magnetic field at audio frequencies which provides an input signal for hearing aids operating with a telecoil. If the field strength is too low then intelligibility and signal to noise ratio are compromised, if the field strength is too high then the hearing aid may be overloaded.

• Field strength at the listening plane (ear height) should be 400mA/m sine wave @ 1kHz and checked using a suitable meter.

5. Provides an even field strength

A Hearing Loop system should provide a constant field strength throughout the listing area so the signal doesn't vary greatly as the users of the system move around.

- Field strength must remain within a tolerance of ± 3dB over the entire listening area.

6. Provides a flat frequency response

Hearing Loop systems can be used to transmit music, the human voice or generally both. Human speech produces specific frequencies to form words. It is essential that the system is capable of replicating these frequencies to maintain the intelligibility of the audio broadcast to the users of the system.

- Frequency response of 100Hz – 5kHz ± 3dB ref. level @ 1kHz Must be maintained across coverage area.
- Ensure that the specified amplifier is capable of generating sufficient power and voltage headroom
- Maintain the correct field strength

7. Displays clear signage, no user request necessary

Induction loops are designed to be invisible. Nobody will use the system if they don't know it is there. Hearing Loops are popular with users because they are a dignified solution that doesn't require them to identify themselves, if they have to ask if a Hearing Loop is present this advantage is lost.

- Signage should be provided at each entry point to the looped space and at least one clearly visible sign should be within it.

8. Can be operated and maintained by venue staff

When installing a Hearing Loop it is not enough to simply make sure that it is working. Staff at the venue must be trained to use systems and help customers. Although a Loop system should be a fit-and-forget feature they are susceptible to 'janitorial adjustments' by untrained parties, mainly because they don't produce an audible signal. They must therefore be regularly checked.

- A Loop Receiver with basic field strength indication must be provided with each loop system and staff must be shown how to use it, how often to check the system and how to make basic fixes.

Assistive Listening signals are inaudible without a receiver and, in the case of hearing loops, the technology that produces the signal is hidden from view, signage has become a critical component in conveying the fact that there is an Assistive Listening service available to the user, this is why it is important that the differences in signage is explained.

Originally the internationally recognised sign was a telephone with a coil to the left and a 'T' to the right, this was common place for many years and systems that have not needed to be replaced or developed may still use this same signage. This sign originally referred to the Telephone setting on a hearing aid (now generally referred to as the T, or Telecoil setting) which would be used in old systems to help hearing aid users connect to telephone speakers. With the development of newer Assistive Listening Devices manufacturers also decided that a more homogenous sign design was needed to help with the international recognition of the systems.

This is now the internationally recognised sign for Assitive Listening Devices in the form of Hearing Loops:

A Guide Hearing Loop System Solutions by Application

This is a simplified guide only and there are exceptions to each application, for example Hearing Loops installed in a room with steel raised access flooring may require an amplifier up to four times more powerful than a system installed in a church on a stone floor - always contact the manufacturer to check.

*Amplifier selection should always be based on loop design type and power / voltage headroom requirements calculated from loop and feed cable length/type and expected metal loss. Never specify a Hearing Loop amplifier based solely on claimed area coverage.

Application	Hearing Loop Amplifier	Loop Type
Meeting room or 1:1 communication requirement in busy or noisy environments	Portable table top loop system	Portable device
Retail Point-of-Sale	Fixed counter loop amplifier	Pre-formed Multi-turn Overspill Loop
Customer Service or Reception Desk	Fixed counter loop amplifier	Pre-formed Multi-turn Overspill Loop
Bank teller or security window	Fixed counter loop amplifier & line-In from duplex intercom system	Pre-formed Multi-turn Overspill Loop
Room with shortest aspect of less than 4 metres	Single output phase amplifier*	Perimeter Loop
Room with shortest aspect of less than 15 metres in a building with no structural metal	Single output phase amplifier*	Perimeter Loop
Room with shortest aspect of less than 15 metres in a building with no structural metal & a stage area for electrical instruments.	Single output phase amplifier*	Cancellation Loop
Room with fixed seating and shortest aspect of less than 15 metres, in a building with modern structural metal construction	Single output phase amplifier*	Simple Single Phase Array (Figure 8 etc.)
Room with shortest aspect of greater than 4 metres, in a building with modern structural metal construction	Dual output phase amplifier, or 2 amplifiers with master/slave configuration and a 90°phase shifter*	Low loss Multi Loop Phased Array
Boardroom with shortest aspect of greater than 4 metres, in a building with modern structural metal construction	Dual output phase amplifier, or 2 amplifiers with master/slave configuration and a 90°phase shifter* & line-in from conferencing system	Low loss Multi Loop Phased Array
Room with shortest aspect of greater than 4 metres, in a building with modern structural metal and a stage area for electrical instruments	Dual output phase amplifier, or 2 amplifiers with master/slave configuration and a 90°phase shifter*	Low Spill Low loss Multi Loop Phased Array
Room with shortest aspect of greater than 4 metres, in a building with modern structural metal and a other Hearing Loops system close by (vertically or horizontally)	Dual output phase amplifier, or 2 amplifiers with master/slave configuration and a 90°phase shifter*	Low Spill Low loss Multi Loop Phased Array

Area Coverage Loops

Do's:

- Do perform a site assessment for electromagnetic background noise and to assess the level of metal in the buildings construction.
- Do check whether raised steel deck floor tiles or aluminium suspended ceiling frames are being used or are proposed to be used.
- Do check if there is a stage or an area where electrical instruments are to be used within or near to the proposed looped area.
- Do check what the use, or uses, of the proposed loop area is going to be (seated, standing, free moving etc).
- Do get help designing complex Multi Loop Phased array systems if you are unfamiliar with the process.
- Do get practical training or help if you are unsure how to install the system to IEC 60118-4 Standard.
- Do calculate the power and voltage headroom requirement of the loop system based on loop/feed cable length and type.
- Do check with the manufacturer that the proposed component parts of your Hearing Loop are fit for the application and are compatible with each other.
- Do carefully select a suitable microphone for you application. Remember that you are trying to capture only the wanted sounds to increase signal to noise ratio.
- When using flat copper tape, ensure that the floor is clean, dry and free from any sharp debris that may puncture the protective bonded film and ground the loop.
- When using flat copper tape on metal flooring, use a layer of insulating tape underneath copper tape.
- Use printed warning tape to bond copper tape to the floor to help mitigate damage by carpet fitters.
- Install the loop cable of copper tape a few centimetres away from the wall to avoid damage by carpet fitters.
- Check for ground loop issues which may cause interference with existing audio visual equipment.
- Commission the system to IEC 60118-4 Standard and provide a Certificate of Conformity for the venue manager.
- Listen to the audio quality of the system with a suitable receiver.
- Ensure that adequate signage has been placed at all entry point to the looped area and within the area itself.
- Train venue staff on how to operate and check the system – and supply a suitable Loop Receiver with basic field strength indication at each venue.

Don'ts:

- Don't specify an amplifier based solely on area coverage statistics stated on manufacturer datasheets.
- Never ignore the effects of metal loss on the system – a perimeter loop is rarely the correct solution in a building with modern construction!
- Don't install a perimeter loop on a wall at ear height – ever. This will overload the hearing aid when standing anywhere near a wall and produce an uneven field strength throughout the room.
- Don't use omnidirectional ceiling or wall mounted microphones in area coverage solutions. This collects all the sound in the room and transmits it to the loop amplifier – and ultimately the hearing aid, which only compounds the signal to noise ratio problem that the Hearing Loop system is supposed to solve.
- Don't assume that the system is working without listening to the signal using a suitable receiver or commissioning it the requirements of the IEC 60118-4 Standard.

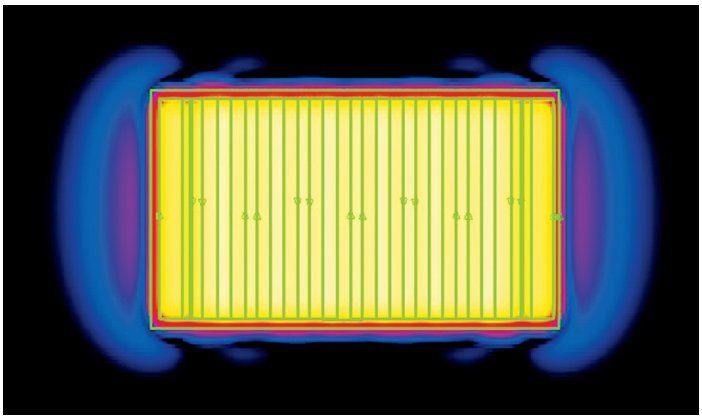


Illustration. Low Spill Multiloop (Phased Array) System

A Note about Hiring Portable Area Coverage Hearing Loop Systems

When considering using or hiring a portable hearing loop system it is still imperative that the system selected is capable of meeting the international Standard for Hearing Loop performance in order that the signal it produces provides a genuine benefit.

The temporary nature of the solution is not an excuse for poor performance, always calculate the power and voltage headroom requirements by loop/feed cable length and never assume that a perimeter loop will be a sufficient solution in modern buildings with metal construction or where the area exceeds 15 meters on it shortest aspect.

Fixed Service Point Loops

Do's:

- Select a suitable microphone and make sure that it is placed as close to the mouth of the operator as possible.
  N.B. If the microphone is too far away from the desired sound source then the unit will not provide any additional benefit over the hearing aid or cochlear implant used on its own.
- Ensure that the preformed loop is attached at a suitable point on the front panel of the desk to provide a good listening experience at the ear height of the intended user (both standing and seated for wheelchair users).
  N.B. The shape of the magnetic field produced by a vertically mounted loop produces null points 'dead spots' in unexpected places – always check the signal using a suitable meter or receiver.
- Make sure the system is wired to activate whenever the till or computer terminal is turned on.
  N.B. The system is inaudible, so it is very easy to forget to turn it on.
- Ensure adequate signage has been placed at the counter and that it will remain visible when people are standing at it in a queue.
- Use the controls on the device to optimise the signal and commission to the requirements of the IEC 60118-4 Standard
- Train venue staff on how to operate and check the system – and supply a suitable Loop Receiver with basic field strength indication at each venue.

Don'ts:

- Don't ignore metal panel construction in the desk. Metal panels can weaken the field produced by the loop requiring a more powerful amplifier.
- Don't use signage to advertise the availability of a Hearing Loop Facility at multiple positions when only a single portable system is available. **N.B. If the intended user of the system has to identify themselves and ask to use it - then the non-discriminatory and dignified nature of the technology is reduced.**

Portable Desktop Loops

Do's:

- Utilise the option for an external microphone (if installed) which should be placed as close as practicably possible to the mouth of the person whose voice needs to be captured.
- If an external microphone is not an option then the person whose voice needs to be captured should adjust their position so they are as close to the on-board microphone as is practicably possible.
  N.B. If the microphone is too far away from the desired sound source then the unit will not provide any additional benefit over the hearing aid or cochlear implant used on its own.
- Ensure that the flat face of the system is facing the person with hearing loss who is using the system, and that it has been set at a suitable distance to maintain comfortable listening.
- Make sure the system is adequately charged before use if an electrical socket is not going to be available.
- Ensure that any auto-off battery saving options do not turn the system off during the duration of operation.
- Maintain the system and batteries, performing regular operational checks with a meter/receiver.

Don'ts:

- Don't use portable counter systems in applications where the operator isn't training on its operation.
- Don't use hearing loop signage to advertise a system as being available at positions where a system isn't permanently situated.
  N.B. If there is no signal the intended user of the system will generally assume the system is broken. Which will reflect poorly on a venue's reputation for the provision of equal access.
- Don't use a portable system in applications where the potential user of the system will not naturally be positioned (both standing and seated) in a space where the magnetic field generated provides a comfortable, intelligible listening experience
- Don't use portable counter systems where an external microphone is not available and the on-board microphone cannot be placed a suitable distance from both the persons mouth who's voice needs to be captured and from the intended user.

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