SigNET

A Guide to Audio-Frequency Induction Loop Systems

PDA Range

Contents

About This Guide

Induction loop systems are more properly termed AFILS, which stands for audio-frequency induction loop systems.

This guide - brought to you by SigNET, manufacturers of the PDA range of audio-frequency induction loop systems - aims to provide straightforward explanations of the technology involved together with hints, tips and advice on best practice installation.

In the UK, the installation of induction loop systems is governed by BS7594 (The Code of Practice for Audio-Frequency Induction Loop Systems) and EN60118-4 (Magnetic field strength in audio frequency induction loop systems for hearing aid purposes), copies of which are available from the British Standards Institute, 389 Chiswick High Road, London W4 4AL. Tel: +44 (0)20 8996 9000. Web: www.bsi-global.com.

Other National standards of design, installation and commissioning should be referenced where pertinent.

This guide should NOT be used as a substitute for any of the above and no responsibility can be accepted by the manufacturer or distributors of the PDA Range of audio frequency induction loop equipment for any misinterpretation of an instruction or guidance note or for the compliance of a system as a whole.

What is an audio-frequency induction loop system?

Audio-frequency induction loop systems allow hearing impaired people to hear more clearly. Most hearing aids have a 'T' or 'MT' switch which allows them to pick up the electromagnetic field generated by an induction loop system. The hearing aid converts this signal into a sound suited to its user's specific hearing requirements.

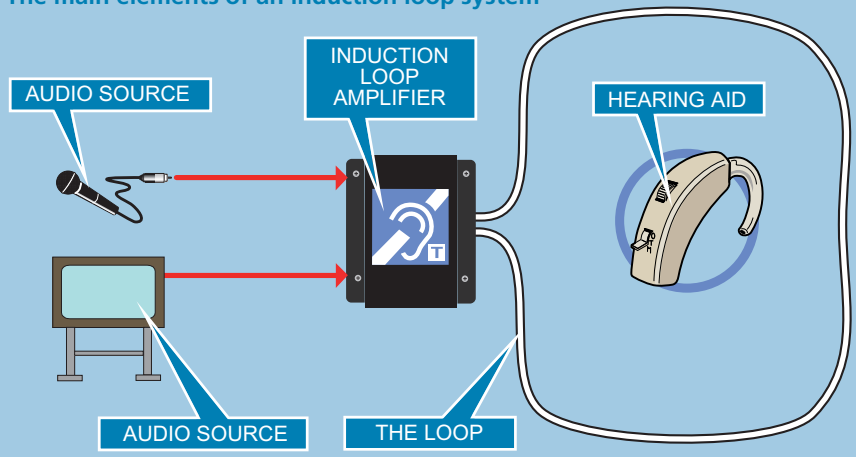
Any person with a hearing aid positioned within or near the loop can hear the loop signal by switching their hearing aid to the correct position, allowing them to participate more effectively in general conversation, ordering goods or services, listening to public performances, etc.

An induction loop system therefore comprises the following main elements:-

- **The audio source** - typically a microphone, television or other audio input (sometimes more than one).
- **The induction loop amplifier**
- **The loop** - typically one or two turns of wire usually run around the perimeter of the room or a special counter loop fixed to the underside of a table or desk.
- **The receiver(s)** - any hearing aid with a 'T' or 'MT' switch or a specially designed loop listening device.

In addition to the many routine benefits for hearing aid users, induction loop systems can also be used for other limited area broadcasting applications such as museum ‘walk through’ guided tours and surveillance talkback systems.

The main elements of an induction loop system



Some induction loop systems may require additional audio sources such as multiple microphone or line level inputs. To facilitate this, many PDA range amplifiers include a patented ‘Outreach’ socket which allows the connection of multiple inputs via a range of specially designed single gang audio connector plates. This system is described in detail on page 26.



How does an audio-frequency induction loop system work?

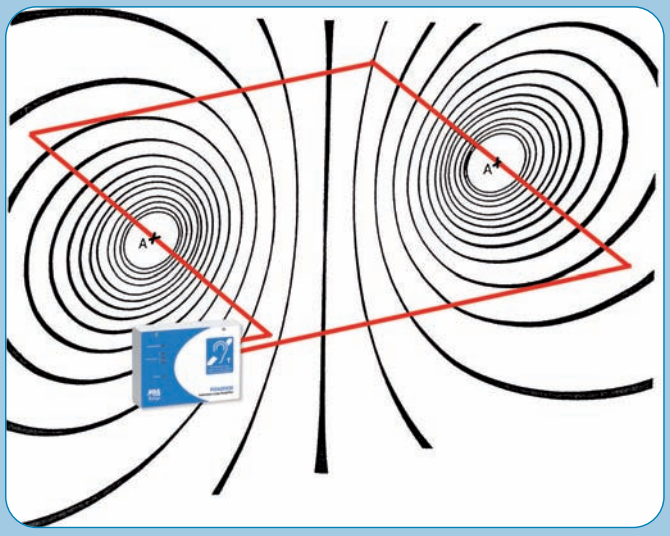
Audio-frequency induction loop systems do not use radio frequencies; they operate at audio frequencies.

The signal from an audio source is fed into an induction loop amplifier, which amplifies and sets the signal level in the same way as a conventional amplifier. The amplified signal, instead of going to a loudspeaker, is fed to a closed loop of cable that is normally placed around the perimeter of the room (although other, more sophisticated 'loop patterns' can be employed). Using a constant current amplifier ensures the current is maintained at the set level whilst providing a flat frequency response without the need for equalisation circuitry.

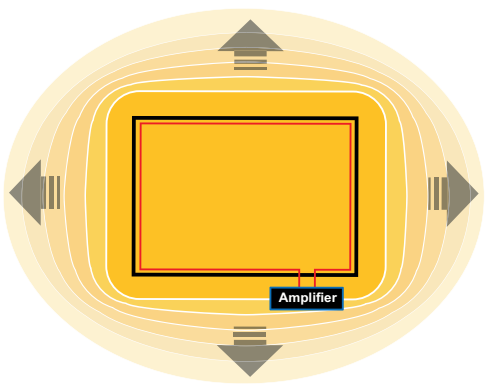
The current flowing through the loop generates a magnetic field that radiates in the space around the loop cable (see diagrams on page 7). Any lines of magnetic flux that pass through the telecoil in a receiver, such as a hearing aid, will generate a current in the coil that is then converted back to audio and fed into the listener's ear.

It is important to remember that the magnetic field will 'bleed' outside the perimeter of the loop and therefore a loop system cannot be considered confidential. Ways of reducing this 'bleed' or 'overspill' are addressed on pages 31-34 of this guide.





Magnetic field in a plane through one axis of a square loop

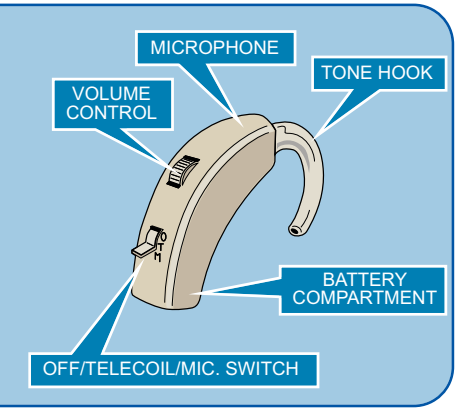


Perimeter loop overspill/bleed

Why we have induction loop systems

In normal use, hearing aids utilise a microphone for amplifying localised speech. Whilst this is effective for local conversations/quiet environments, it is less effective for listening to speech or music at a distance or in front of a security screen at a ticket counter. This is because the hearing aid's microphone also picks up any background noise in the room and unwanted speech from other conversations. An induction loop system works by moving the required sound closer to the hearing aid via the hearing aid's telecoil which is activated by turning it to the 'T' or 'MT' position.

As telecoils are fitted as standard to most hearing aids (over 90% are said to have the 'T' position) induction loop systems can be considered cost-effective compared to other hearing assistance systems. Infrared systems, for example, require special receivers, the cost and maintenance of which must be met by the service provider.



Many modern hearing aids do not just amplify all frequencies equally; they are tailored to suit the user's hearing requirements and amplify different bands by different amounts. This gives maximum intelligibility, so the user has the best chance of understanding what is said.

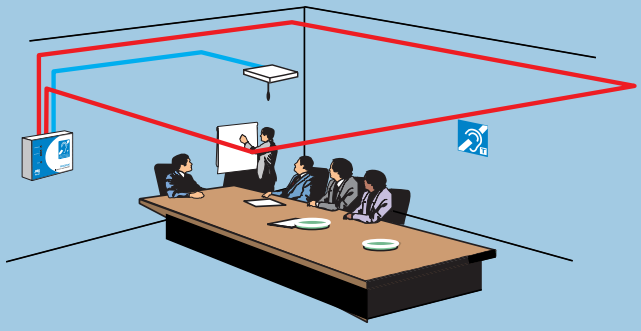


In summary...

Induction loop systems are popular because:-

- Unwanted sounds such as other conversations and background noise are not picked up.
- No special receivers are required - telecoils are fitted as standard in most hearing aids or are an inexpensive option.
- Magnetic induction tends to be more reliable and effective than other systems (infrared, for example, is line of sight only).
- Modern hearing aids amplify different bands by different amounts to suit a user's specific hearing requirements.

Typical counter loop system using a PL1/K1 portable induction loop kit



Typical meeting room system using an AKM3 induction loop kit



Where are 'aids to communication' required?

According to Action On Hearing Loss (formerly the Royal National Institute for the Deaf (RNID)):-

• Over 10 million people (one in six of the UK population) are deaf or hard of hearing.

• An estimated 2 million of these people have hearing aids.

Lobbying by such organisations has led to increased awareness of the difficulties faced by the hearing impaired, so much so that numerous UK Standards, Acts and Schemes now recommend the provision of auxiliary aids such as induction loop systems for the hard of hearing, as summarised below. These summaries refer to the published versions of the documents when going to press. If in doubt, full copies of these documents can be purchased or viewed in their entirety from the organisations and/or websites indicated:-

Building Regulations Part M1 : Access to and use of buildings (2013)

Current building regulations for England and Wales state that newly erected or substantially reconstructed non-domestic buildings should make reasonable provision for people to gain access to and use their facilities (Requirement M1). In particular, the regulations state that reasonable 'aids to communication' should be provided for the hearing impaired in auditoria, meeting rooms, reception areas, ticket offices and at information points. One of the aims of Requirement M1 is to ensure all people can participate in proceedings at lecture/conference facilities and entertainment, leisure and social venues. According to the regulations, aids to communication will satisfy {part of} this requirement if 'a hearing enhancement system is installed in rooms and spaces designed for meetings, lectures, classes, performances ... and at service or reception counters when they are situated in noisy areas or behind glazed screens'(section 4.36/4.36b). The regulations acknowledge that a person with a hearing disability needs to receive a signal that is amplified in both volume and signal-to-noise ratio and that induction loop, infrared, radio and sound field systems

can provide this advanced level of sound (section 4.35, Design Considerations). In larger spaces, provision needs to be made for a permanent system, but in small meeting rooms, a portable induction loop system would be acceptable.

- Building Regulations, Part M1 can be viewed at: **www.gov.uk/government/publications**

BS 8300 (2009)

BS 8300 (2009) British Standard BS 8300 is the code of practice for the design of buildings and their approaches to meet the needs of disabled people. The standard recommends that "a hearing enhancement system, using induction loop, infra-red or radio transmission, should be installed in rooms and spaces used for meetings, lectures, classes, performances, spectator sports or films, and used at service and reception counters where the background noise level is high or where glazed screens are used" (9.3.2). It pinpoints the following areas for consideration: seated waiting areas; ticket sales and information points; fitness suites and exercise studios; churches; crematoria and cemetery chapels, educational, cultural and scientific buildings.

- Copies of BS 8300 can be purchased from the British Standards Institute at: **www.bsigroup.co.uk**

The Equality Act (2010)

The Equality Act (2010) aims to protect disabled people including the hearing impaired. Under the Act (which combines and replaces previous discrimination legislation including the Disability Discrimination Act), all service providers and those providing goods and facilities in Great Britain are required to make changes, where needed, to improve service for disabled customers or potential customers. There is a legal requirement to make reasonable changes to the way things are done, to the built environment and to provide auxiliary aids and services (such as providing information in an accessible format, an induction loop for customers with hearing aids, special computer software or additional staff support when using a service). Employers must also take measures to ensure that employees are not disadvantaged in the workplace.

- For more information, visit the Government Equalities Office at: **www.gov.uk/government/organisations/government-equalities-office**

The Human Rights Act (1998)

The Human Rights Act guarantees everyone, including the hearing impaired, fundamental rights and applies to public authorities including government departments, local authorities, courts, schools, hospitals, GP surgeries, prisons, public libraries and many more. If a deaf person believes their rights have been denied, they may be able to bring a case under the Act.

- For more information, visit **www.equalityhumanrights.com**

Care Standards Act (2000)

The Care Standards Act demands that care homes in England provide certain adaptations and equipment for residents, including:- 'facilities, including communication aids (e.g. a loop system), and signs to assist the needs of all service users, taking account of the needs, for example, of those with hearing impairment, visual impairment, dual sensory impairments, learning disabilities or dementia or other cognitive impairment, where necessary.'(standard 22.6). These requirements apply to all care homes providing accommodation and nursing or personal care for older people in England. Regular inspections and enforcement of the legislation is now carried out by the Care Quality Commission (CQC)

- For further details visit the Care Quality Commission's website at **www.cqc.org.uk**

Installation & performance standards

BS 7594 (Code of practice for audio-frequency induction loop systems) gives recommendations for and guidance on the design, planning, installation, testing, operation and maintenance of an audio frequency induction loop system intended for communicating speech, music and/or other signals. The performance requirements of an induction loop system is specified in **BS EN 60118-4 (Magnetic field strength in induction loop systems for hearing aid purposes)**

This guide provides basic advice on how to meet the above using the PDA range of induction loop systems. However, it should not be used as a substitute for the standards and/or any other regulatory or legislative documents that may exist.

Which induction loop system should I use?

The PDA range of induction loop equipment comprises a huge range of amplifiers, microphones, connector plates, loop cable and test equipment covering every conceivable AFILS application.

Designed to meet or exceed the requirements of BS 7594 and EN60118-4, our amplifiers offer excellent intelligibility, true current mode amplification, 'phantom' power (for use with electret microphones) and full compatibility with our Outreach plate audio input extension system.

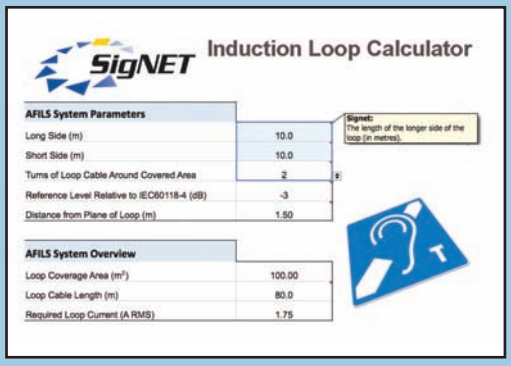
Much of our equipment is available in kit format for ease of use, specification, purchase and installation.

Before deciding which induction loop system to use, you first need to ascertain the size of the area to be covered. Bear in mind it may not be necessary to cover the whole of the area, for example in a church only the pews may require coverage. You may also need to consider using 2 turns of cable to increase field strength, this is possible due to the high voltage overhead available in the PDA range of induction loop amplifiers.

To assist you in selecting the best amplifier and loop cable for a particular application, a powerful induction loop calculator can be downloaded from our website at **www.signet-ac.co.uk** - details on how to use this calculator can be found overleaf.

Utilising sophisticated formulas devised by engineers at our R&D facility, the calculator helps system designers and installers determine which induction loop amplifier and cable they should use to create a compliant AFILS installation.

Our induction loop calculator (available from www.signet-ac.co.uk) is compatible with any Mac or PC computer running Microsoft Excel and is designed to work in five easy steps



1. *Enter the room length and width*
2. *Select/alter the number of turns in your loop (extra turns can provide increased field strength in smaller rooms)*
3. *Select the reference level (normally -3dB but this can be reduced to -6dB)*
4. *Set the height of measurement in metres from the plane of loop*
5. *Consult the wire dependent loop choice box to see exactly which amplifier and loop cable best suits your application*

IMPORTANT NOTES:

• The calculator assumes a perimeter loop is being installed (i.e. a square or rectangular loop that is being run around the edge of the covered area). This will not be suitable for all applications due to overspill considerations, see pages 31 to 34 for further details.

• Although the amplifier recommended by the calculator WILL generate the required magnetic field, it is the responsibility of the designer/installer to ensure the amplifier has the required inputs and features pertinent to the job in hand.

• Prior to installation we always recommend a trial loop is run around the covered area and that the system is tested to ensure correct operation using one of our FPROK1 test kits which includes a handheld magnetic field strength meter and a calibrated signal generator (c/w test tones and headphones).





1.2m² PL1 portable induction loop system

- Ideal for restricted person to person contact in areas such as banks, post offices, small meeting rooms, reception desks, open plan offices and ticket booths
- Portable, lightweight design means the system can be moved easily from location to location
- Simple one button operation
- Integral high performance microphone
- Five years' expected battery life under normal operating/charging conditions
- Auto shut-off facility (user selectable for 10, 30 or 60 minutes) helps preserve battery life
- Unit can be used as normal whilst charging

Typical PL1/K1 meeting room application

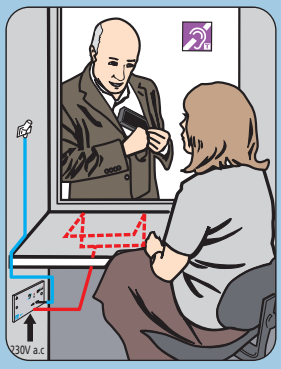
Typical PL1/K1 counter/ticket booth application

TYPE	Portable
COVERAGE	1.2m² approx.
DIMENSIONS	W 271 x H 200 x D 77mm (amplifier only); 2.82kg
INPUTS	2 x Mic (one built-in mic. and one 3.5mm remote mic. socket for AMT or AMD mics)
INDICATORS	Power on; input level; charging required; charging in progress, audio warning of imminent shutdown
CONTROLS	On/off button; adjust auto-shut off timer
KIT VARIANTS	PL1/K1 : PL1 amplifier, plugtop charger, 'AFILS available' sticker, cardboard carry case. PL1/K3 : As PL1/K1 but in a robust plastic carry case



1.2m² ML1/K double gang fixed counter induction loop system

- Ideal for banks, post offices, small meeting rooms, reception desks, ticket booths and any other application requiring restricted or small area coverage
- Requires no specialist audio experience or connectors - can be fitted by any competent electrician
- Space-saving double-gang wall-mounting amplifier fits standard UK 25mm back boxes (requires fixed mains wiring).
- Omni-directional AMT microphone (supplied) plugs directly into 3.5mm socket on the amplifier's front
- Line/outreach socket also provided (max 3 outreach plates per system)
- User-adjustable mic. sensitivity and engineer-adjustable loop drive and input level controls



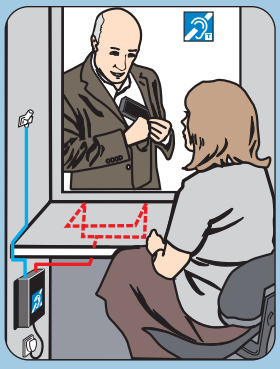
Typical ML1/K counter/ticket booth application

TYPE	Wall mounting (requires fixed mains wiring and a 25mm back box)
COVERAGE	1.2m² approx.
DIMENSIONS	W 143 x H 83 x D 32mm; 300g (amplifier only)
INPUTS	1 x 3.5mm remote mic. socket; 1 x Line/Outreach socket (max. 3 Outreach plates per ML1)
INDICATORS	Input level; power on; loop drive meter.
CONTROLS	Mic. input level, line input level; loop drive
KIT CONTENT	ML1 amplifier; AMT microphone; TX2 pre-formed counter loop; 'AFILS fitted' sticker.



1.2m² PDA102C free-standing counter induction loop system

- Ideal for banks, post offices, small meeting rooms, reception desks, ticket booths and any other application requiring restricted or small area coverage
- Includes a 3.5mm microphone input (for use with the AMT microphone supplied) and a line/outreach socket
- Adjustable drive control allows the amplifier's output stage to be set-up to suit the exact characteristics of any room
- State-of-the-art audio processor features an automatic gain control which compensates for poor microphone techniques and helps suppress loud noises, hisses and clicks
- Designed to be free-standing or wall-mounted using the keyholes provided



Typical PDA102C counter/ticket booth application

TYPE	Free-standing/wall mountable. Plugtop mains lead supplied
COVERAGE	1.2m² approx.
DIMENSIONS	W 136 x H 56 x D 178mm (amplifier only); 1.25Kg
INPUTS	1 x 3.5mm remote mic. socket; 1 x Line/Outreach socket
INDICATORS	Input level; loop current; power on
CONTROLS	Combined input level; loop drive
KIT CONTENT	PDA102 amplifier; AMT microphone; TX121 pre-formed counter loop; 'AFILS fitted' sticker

A European version of the PDA102C is also available c/w a Schuko plug adaptor, black, 7.5A (order PDA102C/SH)



1.2m² VL1/B1 12V vehicle induction loop system

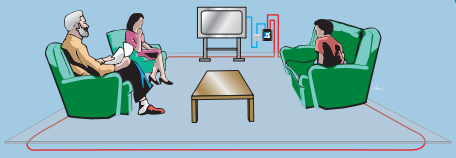
- Ideal for cars, taxis, buses and other private/commercial vehicles
- Amplifier operates at 12V d.c (24V vehicle kit also available, order code VL1/B2)
- Kit includes a compact mini-induction loop amplifier (pictured), keyholes for dashboard mounting, a cigarette lighter power adaptor, an AMT microphone, a pre-formed loop and an 'AFILS' fitted' sticker
- Loop can be positioned in the vehicle's roof lining, under a seat, across the back of a seat or in a door panel to suit the application
- Metal compensation control helps combat the frequency response problems caused by metal 'absorbing' the magnetic field
- Optional VL9 lead available for connection to the vehicle's audio system

TYPE	Dash mounting; 12V
COVERAGE	1.2m² approx.
DIMENSIONS	W 120 x H 31 x D 60mm; 220g.
INPUTS	1 x 3.5mm remote mic. socket; 1 x line
INDICATORS	Input level, loop current, power on
CONTROLS	Mic level; Line level, loop drive, metal compensation
KIT VARIANTS	• VL1/B1: VL1 Amplifier; TX2 Pre-formed loop; AMT microphone; AL8 Fused cigarette lighter power adaptor; 'AFILS fitted' sticker • VL1/B2 : VL1 Amplifier; TX2 Pre-formed loop; AMT microphone; VL1PSU24 24V to 12V convertor; AL7 2.5mm DC power plug to bare end lead; 'AFILS fitted' sticker.

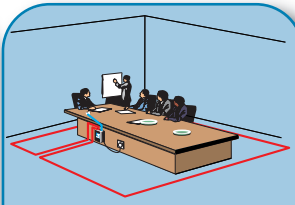


50m² PDA102L/R/S small room induction loop systems

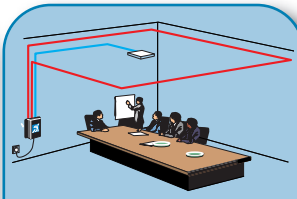
- Three variants available
- PDA102L ideal for use in small meeting rooms, council chambers, doctors' surgeries, etc.
- PDA102R ideal for small room applications where equipment needs be mounted above suspended ceilings, etc.
- PDA102S ideal for use in nursing home TV lounges
- Includes a 3.5mm microphone input and line/outreach socket
- Designed to be free-standing or wall-mounted using the keyholes provided



Typical PDA102S TV lounge application



Typical PDA102L meeting room application



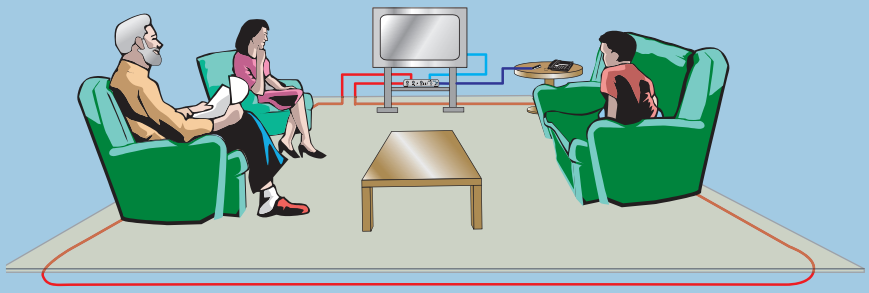
Typical PDA102R meeting room application

TYPE	Free-standing/wall mountable. Plugtop mains lead supplied.
COVERAGE	50m² approx. (note that loops over 16m² may require two turns of loop cable)
DIMENSIONS	W 136 x H 56 x D 178mm (amplifier only); 1.25Kg
INPUTS	1 x 3.5mm remote mic. socket; 1 x Line/Outreach socket
INDICATORS	Input level; loop current; power on
CONTROLS	Combined input level; loop drive
KIT VARIANTS	PDA102L: PDA102 amplifier; AMT tie/desk microphone; 40m loop cable; 'AFILS fitted' sticker PDA102R: PDA102 amplifier; APM plated microphone; 40m loop cable; 'AFILS fitted' sticker PDA102S: PDA102 amplifier; APL dual phono outreach plate, APS Scart lead; 40m loop cable; 'AFILS fitted' sticker. Loop cable IS NOT included in our 'AK' Range kits. Use 1mm² single core cable such as our LOOP2/W cable or for more precise recommendations, download our free AFILS loop calculator as detailed on page 14 European versions also available c/w a Schuko plug adaptor, black, 7.5A (add /SH to the UK part no.)



50m² DL50/K domestic induction loop system

- Free-standing - ideal for bedrooms, living rooms, TV lounges, studies and other domestic applications
- Simple to adjust, tamper-resistant drive, level, tone and mic. priority controls
- Input peak, output current, signal present and power on LEDs
- Alert tone input for doorbells, fire alarms, security systems, etc.



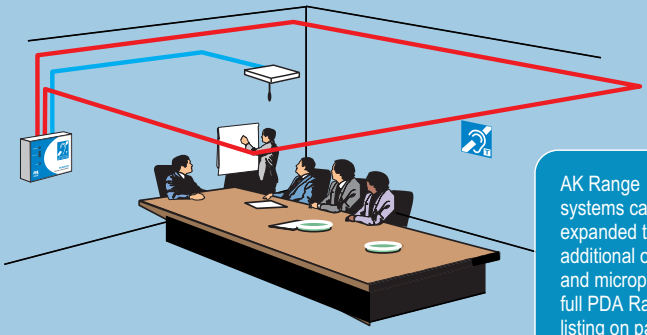
Typical DL50/K TV lounge application

TYPE	Free standing, Plugtop mains lead supplied.
COVERAGE	50m² approx. (note that loops over 16m² may require two turns of loop cable)
DIMENSIONS	W 185 x H 40 x D 85mm (amplifier only); 550g
INPUTS	2 x 3.5mm microphone sockets, 1 x dual phono (line) socket, 1 x alert
INDICATORS	Input level; loop current meter; power on
CONTROLS	Input level, loop drive, tone, microphone priority
KIT CONTENT	DL50 amplifier, plug-top power supply, 16m of loop cable, SCART-to-double-phono lead, AMT microphone, 'AFILS fitted' sticker



200m² AK Range induction loop amplifiers and kits

- Available in a wide range of kit formats - suitable for use in meeting rooms, waiting rooms, TV lounges, health and fitness suites, churches, etc (see kit list below)
- PDA200E amplifier includes straightforward internal screw connectors
- Wall-mounting metal enclosure for permanent installation
- Internal drive, level and metal compensation controls



Typical AKM3 meeting room application

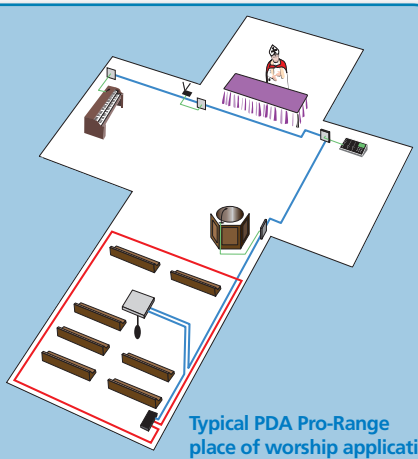
AK Range systems can be easily expanded to include additional outreach plates and microphones - see our full PDA Range parts listing on pages 38-39

TYPE	Wall mounting, requires fixed mains wiring
COVERAGE	200m² approx.
DIMENSIONS	W 271 x H 200 x D 77mm (amplifier only); 2.82kg
INPUTS	1 x Microphone, 2 x Line/Outreach (all screw type connectors)
INDICATORS	Input level; power on; compression; peak current (3,2,1)
CONTROLS	Input level, loop drive, metal compensation
KIT VARIANTS	**AKM1 Meeting room kit; AKM3 Professional meeting room kit; AKL1 Lecture room kit; AKT1 TV / music lounge kit; AKR1 Waiting room kit; AKU1 Retail unit kit; AKW1 Place of worship kit 1; AKW2/L Place of worship kit 2; AKW2/H Place of worship kit 2; AKH1/L Health & fitness club kit; AKH1/H Health & fitness club kit:** Please see page 38 for full kit contents



200m² to 1000m² PDA Pro-Range induction loop amplifiers

- Ideal for theatres, cinemas, churches, conference halls and other applications where top quality sound is a must
- Each unit includes two XLR 3-pin input sockets (one balanced mic. and one switchable balanced mic./line) and one outreach connector.
- Adjustable level controls for each input - can be used individually or as a three-input mixer



Typical PDA Pro-Range place of worship application

- Metal compensation control
- Includes a true output current meter and provides visual indication of the amplifier's compressor action via two LEDs
- 3.5mm headphone socket allows true monitoring of the output signal
- Advanced audio signal processing with automatic gain control

UL 60065 listed PDA Pro-Range amplifiers are now available for North America and Canada comprising the:-

PDA200/2/UL (2,150 sq.ft. coverage)
PDA500/2/UL (3,380 sq.ft. coverage)
PDA1000/2/UL (9,680 sq.ft. coverage)

Contact our sales department for details

TYPE	Free-standing (optional wall or 2U 19"rack mount kits available); plugtop IEC mains lead provided
COVERAGE	200m² (PDA200/2); 500m² (PDA500/2); 1000m² (PDA1000/2)
DIMENSIONS	W 380 x H 80 (2U) x D 220mm; 3.74kg (PDA200/2), 3.46kg (PDA500/2); 4.54Kg (PDA1000/2)
INPUTS	2 x XLR (one mic.; one mic/line) and one outreach connector
INDICATORS	Input level; loop current meter; power on
CONTROLS	3 x input level controls, loop drive, metal compensation, on/off switch

European versions are also available c/w Schuko plug adaptors, black, 7.5A (add /SH to the UK part nos)



DLR Dual induction loop amplifier kits for Phased Array Loops

- Our new DLR range of dual induction loop amplifier kits are designed to simplify the installation of a 'phased array' induction loop system.
- Each pre-wired DLR kit features two PDA Pro-Range induction loop amplifiers (see page 22), an APPS Phase Shifter and two outreach plates providing one XLR mic and one dual phono line input.

- Suitable for use in areas up to 200m^2, 500m^2 or 1000m^2 (dependent on the model purchased)
- Supplied in an attractive 4U enclosure
- Ideal for use in high-profile professional applications where minimal overspill and consistent loop coverage (i.e. no dead spots) is essential.

What is a phased-array induction loop system?

A phased-array induction loop system works by producing two AFILS signals that are 90° out of phase with each other. These signals are connected to two induction loops laid out in a special overlapping pattern (see page 33). The resultant magnetic field is evenly spread within the covered area and the field strength falls off very quickly outside the loop.

TYPE	Dual induction loop amplifier kits for phased array loops. 2 x plugtop IEC mains leads provided
COVERAGE	200m^2 (DLR5); 500m^2 (DLR7); 1000m^2 (DLR9)
DIMENSIONS	W 600 x H 270 x D400mm; 2.40kg (DLR5), 17.84kg (DLR7), 22kg (DLR9)
INPUTS	1 x XLR mic (via APXM plate) and 1 x dual phono (via APL plate)
OUTPUTS	1 x 3.5mm remote mic. socket; 1 x line
INDICATORS	2 x induction loop connection plates
CONTROLS	Loop drive meter; compression (high/low); power on (per amplifier)
KIT VARIANTS	Input level, loop drive, metal compensation

European versions also available c/w Schuko plug adaptors, black, 7.5A (add /SH to the UK part nos)



Microphones

A microphone is perhaps the most important link in an audio chain. As the connection between the sound source and the sound system, it must interact efficiently with both. Choosing this link successfully requires knowledge of the sound source, the sound system (including the room acoustics), microphones and the actual application.

The most common microphones used are lectern, handheld, boundary and lavalier. Best practice (though not always possible) is to place the microphone(s) as close as possible to the speaker.

A method that is sometimes suggested for overhead placement is a ceiling-mounted boundary microphone. This should be used with caution as (a) it often places the microphone too far from the desired sound source, especially where there is a high ceiling and (b) the ceiling is often an extremely noisy location due to air handling noise, lighting fixtures and vibration. Electret microphones have the highest tolerance of magnetic feedback and are therefore recommended for loop systems. Dynamic microphones should not be used as they contain moving coil magnets which can be affected by the magnetic field generated by the loop. Phantom power is provided on all PDA range amplifiers, so electret microphones with internal batteries are not necessary. When deciding which microphone to use, the following guide should prove useful.

To avoid interference, microphone cables should be sited at least one metre away from loop cable.

Microphones, SCART leads, etc

APM Omni-directional plated mic

For direct connection to PDA200E or an outreach chain

AML Lectern microphone

For direct connection to PDA200E or APJ outreach plate

AMP Professional microphone

For direct connection to PDA200E or APXM outreach plate (requires AXLR lead)

AMD Desktop microphone

For direct connection to PDA200E or APJ outreach plate

AMT Tie/desk microphone

For direct connection to PDA200E or APJ outreach plate

AMH Handheld microphone

For direct connection to PDA200E or APJ outreach plate

PRO45 Hanging microphone

For direct connection to PDA200E or APJ outreach plate

APS Scart Lead

For connecting TVs, CD players, etc. to an APL outreach plate

AMR/H Handheld Radio microphone

c/w mic, receiver, transmitter, psu For direct connection to PDA200E or APQM outreach plate

AMR/L Lavalier Radio microphone

c/w mic, receiver, transmitter, psu For direct connection to PDA200E or APQM outreach plate



Microphone selection chart

APPLICATION / MICROPHONE TYPE	MODEL NO.
Conference table (centre of tabletop, counter, etc)	AMT tie/desk mic
	APM plated mic
	MH handheld mic + G121 stand
	AMP* professional handheld mic + G121 stand
Lectern (for pulpits, lecture theatres, etc)	AML fixed gooseneck mic, long stem
	AMLS fixed gooseneck mic, short stem
	AMD moveable gooseneck mic, long stem
	AMDS moveable gooseneck mic, short stem
Lavalier (for the lapel of an after dinner speaker)	AMT tie/desk mic
	AMR/LA (radio mic) - 4 selectable frequencies
Ambient mic (for audience response etc)	APM at distances of ≤2.5m
	PRO45 at distances ≥ 2.5m
Ceiling (recessed in the ceiling above a table)	APM at distances of ≤2.5m
	PRO45 at distances ≥ 2.5m
Desk Microphone with Push To Talk (PTT)	AMD/P (as AMD with PTT)
Handheld	AMH handheld mic
	AMP* professional handheld mic
	AMR/HA (radio mic) - 4 selectable frequencies

*All PDA range microphones are supplied with a connection lead apart from the AMP professional handheld mic. If using an AMP, a range of connection leads are available, contact our sales desk for details.

Our APM plated mic is designed to cover areas up to 25m^2 (5m x 5m). To cover larger areas with this microphone, divide the area of the room by 25 to work out how many APMs are required and lay them out in a grid pattern (max. 10 APMs). Alternatively, you may wish to consider using a radio mic (AMR) or hanging ambient mic (PRO45).



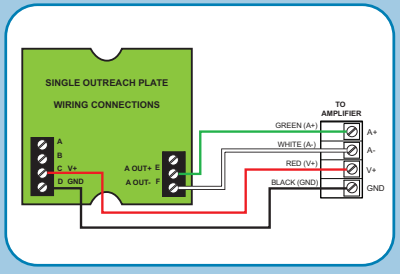
The Outreach Plate audio input extension system

The Outreach Plate audio input extension system comprises a range of wall, ceiling and desk mountable single gang audio input plates specifically designed to increase the audio input capability of an induction loop system. Covering the most common variants of audio connector, they work by mixing the signals from various audio input sources into one balanced line level input which can be fed into the line input of a compatible amplifier.

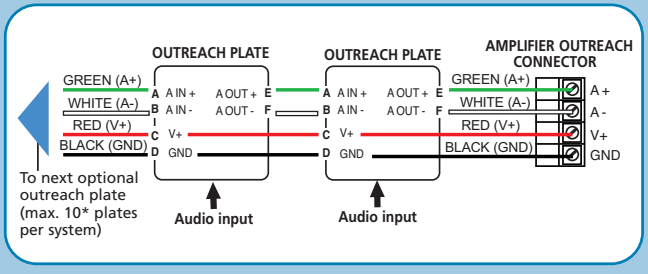
Mountable on 25mm back boxes, each plate features a built-in mixer, pre-amp, input level control and balanced output. The fact they can be installed at the most convenient point on an installation overcomes the need for long and potentially hazardous microphone/audio leads.

Typically, up to 10* Outreach plates (any mix) can be daisy-chained to one balanced line level input with cable lengths of up to 100m easily achievable using standard two-pair audio cable (such as Belden 8723) with no recognisable degradation of audio signal quality.

Each outreach plate requires four wires, two balanced line (A +, A –), one ground (0V) and one power connection (12-32 V DC regulated).



Connecting a single outreach plate to equipment with an 'Outreach' socket



Connecting multiple outreach plates to equipment with an 'Outreach' socket

Outreach plate input variants

APM OMNI-DIRECTIONAL PLATED MICROPHONE

A self-contained omni-directional electret microphone complete with onboard mic to line level converter. Typical coverage up to 25m² (ambient) or 2.5m (direct speech) when located at a ceiling height of 2.5-3m.

APL DUAL PHONO LINE LEVEL PLATE

Accepts stereo phono line-level signals (usually from a stereo source such as a TV). Includes an on-board stereo phono to mono converter. (An APS SCART to dual phono lead is also available).

APJ 3.5mm MICROPHONE JACK PLATE

Accepts unbalanced electret microphones with 3.5mm mono jack plugs. Includes an onboard mic to line level converter, high gain pre-amplifier and 8V phantom power.

APQM 6.35mm (1/4") MICROPHONE JACK PLATE

Accepts balanced or unbalanced electret microphones with 6.35mm (1/4") jack plugs. Includes an on-board mic to line level converter, high gain pre-amplifier and 8V phantom power.

APQL 6.35mm (1/4") LINE LEVEL PLATE

Accepts 6.35mm (1/4") jack feeds from audio equipment such as stage or church mixing desks, etc.

APXM XLR 3 PIN MICROPHONE PLATE

Accepts balanced or unbalanced microphones with standard 3 pin XLR connectors. Includes an on-board mic to line level converter, high gain pre-amplifier and 8V phantom power.

APXL XLR 3 PIN LINE LEVEL PLATE

Accepts standard 3 pin XLR feeds from audio equipment such as stage or church mixing desks, etc.

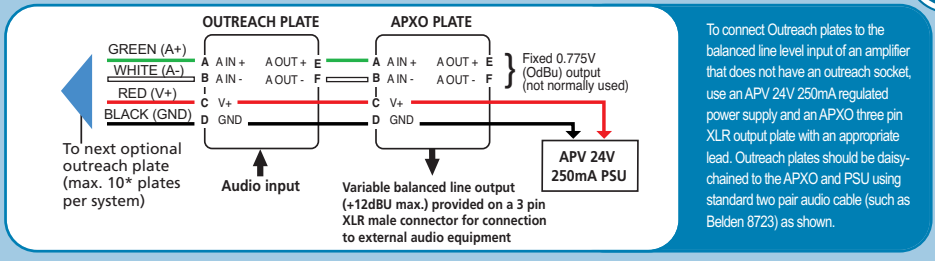
Outreach plate output variants

APXO XLR 3 PIN BALANCED LINE OUTPUT PLATE

Provides an adjustable balanced line output (+12B max.) on a standard 3 pin male XLR connector. Typically used to connect an Outreach chain to third-party audio equipment such as conventional amplifiers.

API 'AFILS ACTIVE' PLATE

Includes two ultra-bright LEDs in a translucent diffuser overprinted with the AFILS 'ear' symbol. The LEDs illuminate when the Outreach network is powered to indicate that an AFILS system is installed.



To connect Outreach plates to the balanced line level input of an amplifier that does not have an outreach socket, use an APV 24V 250mA regulated power supply and an APXO three pin XLR output plate with an appropriate lead. Outreach plates should be daisy-chained to the APXO and PSU using standard two pair audio cable (such as Belden 8723) as shown.

Connecting outreach plates to equipment that does not have a 12-32V d.c. output

Induction loop system design and installation

AFILS design and installation can be simple provided a few basic facts are understood.

Maximum area coverage

The approximate coverage provided by an AFILS amplifier is usually quoted in metres squared (m^2). For example, the 200m^2 quoted for our PDA200E amplifier means that the PDA200E can cover rooms up to 14 x 14m in size.

The PDA range has amplifiers that can cover everything from a 1.2m^2 ticket counter to a large 1000m^2 conference hall. It is important to note that these areas are calculated in free space and do not take into account metal structures that could profoundly affect loop performance. Metal loss can usually be overcome by using special loop patterns (see pages 32-34) and/or amplifiers with metal compensation such as our PDA200E or PDA Pro-range units. In rooms with excessive metal, conventional (i.e. perimeter) loops greater than 5m wide are best avoided and a phase shifted loop arrangement would be better employed (see page 33).

Note that in certain installations, it may not be necessary to cover the whole room, i.e., in a bowling alley the loop may only need to cover the top of the lanes.

Loop amplifier position

Induction loop amplifiers are best sited adjacent to the loop, as the feed cable will generate a magnetic field that may interfere with other areas. However, if a long feed cable cannot be avoided, the cable should be twisted to reduce magnetic radiation.

Loop cable

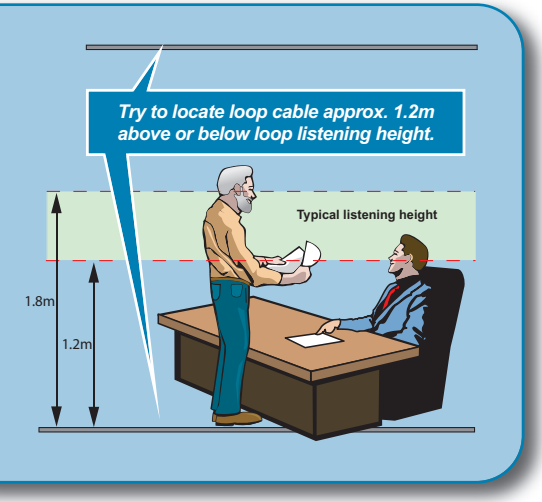
There is nothing electrically special about induction loop cable and SigNET can supply two types: 100m reels of single core loop cable (0.5mm^2, 1.0mm^2, 1.5mm^2 and 2.5mm^2) and 100m reels of flat copper foil tape (0.5mm^2, 1.0mm^2, 1.5mm^2). Copper foil tape is typically used for floor loops under light duty carpets. Protective tape is also required to hold the cable down and reduce the likelihood of damage. Copper foil tape should be connected to the loop amplifier using solder or 1A 'choc' block.

To determine the best loop cable to use for a particular application/room size, please refer to our online induction loop calculator as detailed on pages 13/14.

Note that the chemical elements of some self-levelling floor compounds can react with the plastic covering of copper foil tape. If installing the loop under such compound, we recommend you check compatibility by covering a small piece of the tape with the compound to be used and look for adverse reactions.

Loop cable position

Under current IEEE wiring regulations (17th Ed.), loop cable is classified as class 2A and must be sited at least 600mm away from telephone, mains and control cables.



In straightforward, low metal content installations, loop cable is usually run around the perimeter (edge) of the room.

The field strength in the plane of the loop (the height at which the cable is positioned) varies so it is best to install the loop above or below the listener at floor or ceiling height. The loop field will not be as strong but it will be much more even and provide better results.

Do not mount the loop cable at head height unless you can guarantee that a hearing aid user will not be closer than 1.2m to it as the loop signal will be uncomfortably strong for them.

Ceiling loops

Try to locate ceiling loops approximately 1.2m above the listener's head (listening height with the hearing aid user sitting or standing is normally 1.2 to 1.8m from the floor). Note that when using a ceiling mounted loop, approximately 20% of the amplifier's power will be lost for every 1.5m increase in height so the cable should never be mounted higher than 3m above listening height.

Structural steel, in particular, large sheets of metal (solid or perforated) such as metal suspended ceilings, can absorb the magnetic field resulting in uneven coverage or dead spots. It will also affect frequency response within the loop. To avoid the magnetic field being absorbed by structural steel, if possible keep the loop about a metre from large uprights.

Suspended ceilings

If an application has a suspended ceiling with a metal grid and non-metallic ceiling tiles, tie-wrap the loop cable to the support wires a couple of centimetres above the tiles. If the tiles are metallic, the field strength will be affected, especially if they are electrically cross-bonded although it may be possible to partially overcome this by increasing the drive control on the amplifier. If single core cable fails to provide the required field strength in such applications, consider using multi core cable (of appropriate gauge) and 'choc block' to create two loops in series. Although this technique increases field strength it also reduces the top-end audio frequencies making the loop sound bass heavy, however this can be redressed using the metal compensation control on the PDA200E or PDA Pro-Range of amplifiers.

Floor loops

If there is a steel-reinforcing grid in the floor, either put the loop in the ceiling or, if it must go in the floor, install the loop in plastic conduit as far above the grid as possible. The amplifier's drive current may have to be turned up to overcome the effects of metal, so choose the largest conductor size possible to suit the area. Other methods; such as running two turns of cable or using a phase shifted loop array can also overcome the effects of metal loss.

Sloping floors

In applications with flat ceilings and sloping floors (cinemas, theatres, etc), try to run the loop at the same angle as the floor, perhaps behind a non-metallic handrail (if one is available) to ensure the signal is distributed evenly throughout the building. Remember, however, that the loop should not get any nearer than 1.2m to any prospective hearing aid position.

Door openings

On floor loops, avoid running the loop up and over door openings as there will be a fluctuation when the hearing aid user passes through. At doors and windows, the loop cable can pass vertically up and down either side. However, this wastes some power so care should be taken if the amplifier is only just capable of covering the area. Generally, we would suggest allowing 20% less area coverage than the amplifiers maximum stated square metre coverage if vertical runs are needed.

Areas with retractable seating

For areas such as theatres with retractable seating, a phase shifted loop array should be considered with flexible tubing to protect cross points. See page 33.

Trial loops

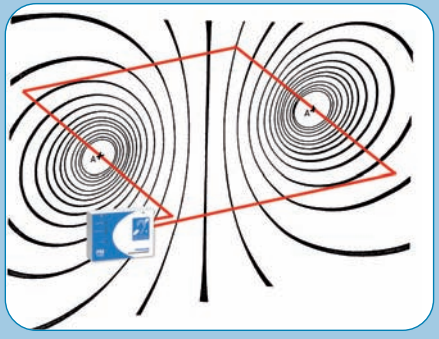
Always run a trial loop and test to evaluate performance by listening to the signal with either a hearing aid or a dedicated loop listening device. To ensure the system complies with BS 7594 we recommend you also test the system using the equipment and procedure outlined on pages 36-37.

Dead spots

In the region directly above or below the loop cable, the signal will drop to zero. This is because a hearing aid's coil only responds to the vertical component of magnetic field. The higher the loop is placed, the wider the dead spot immediately over and under the cable will be.

Overspill

The signal generated by the induction loop will appear outside as well as inside the loop - sometimes up to three times the loop width away. This is often referred to as 'overspill'. Similarly, a loop placed at ceiling height gives excellent coverage in the room above and a loop placed at floor level will cover the room below. Placing the downstairs loop in the floor and the upstairs loop in the ceiling will reduce the problem but if the loops are large the overspill may still be unacceptable.



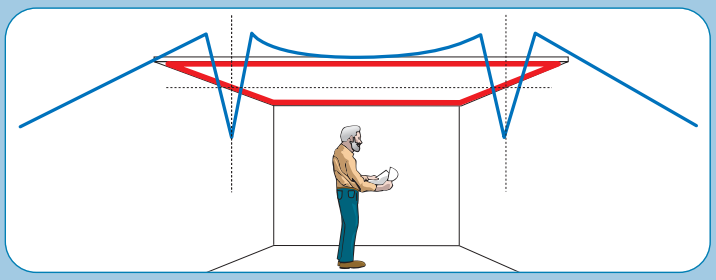
Typical Induction loop application

The importance of overspill depends on the application. For instance, it will probably not matter if a church service can be picked up in the church grounds. However, should the signal from one loop system interfere with another in a multi-screen cinema, or a confidential loop signal in a police station be picked

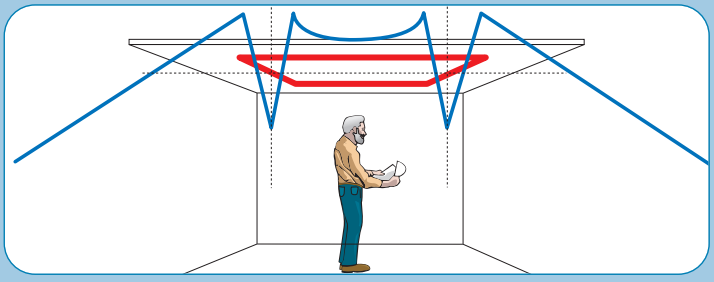
up by an unauthorised person in a neighbouring room, this is more concerning. BS 7594 suggests several technically complex solutions to prevent overspill that are reasonably effective. In many cases overspill can be reduced nearly as effectively and for much less cost, using the special loop patterns described below.

'Low overspill' reduced sized loops

One of the most obvious and cost-effective ways of reducing overspill is to install a reduced sized loop within the area requiring coverage. We can estimate how much overspill there will be by looking at the width of the loop (which controls the overspill). For example, if we look at the following diagram of a 4m x 6m perimeter loop you can see the signal overspills outside the room before dropping off to an inaudible level at around 12 metres.



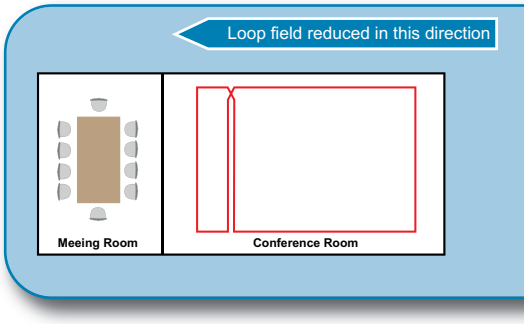
Logically, if we wanted to reduce the overspill we can move the loop into the room moving the overspill with it, thus:-



It is important to remember there will be a dead spot immediately above or below the loop cable and that anyone sitting over it won't hear anything (this is due to the fact that hearing aid coils only respond to the vertical component of the magnetic field). However, unless the loop is a long way above or below the listener, this 'dead' spot will be very narrow and it is often an acceptable compromise in return for reduced overspill. In our experience, the loss of some areas in the room to hearing aid users is accepted as a 'reasonable provision' as long as the person responsible for the room is made aware of this.

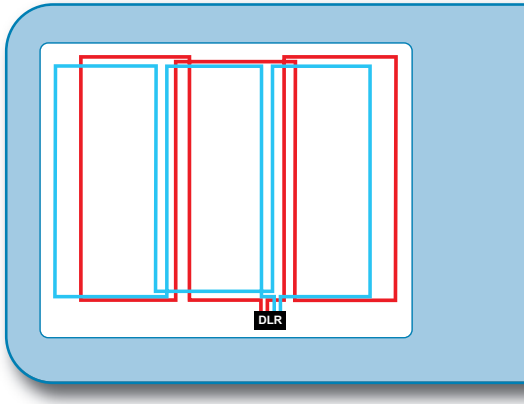
Reducing overspill in one direction

For applications where overspill need only be reduced in one direction a 'cancellation' loop can be used as per the drawing on the right. However as with all loop installations; it is important to run a trial loop(s) to ensure the system is working as predicted.



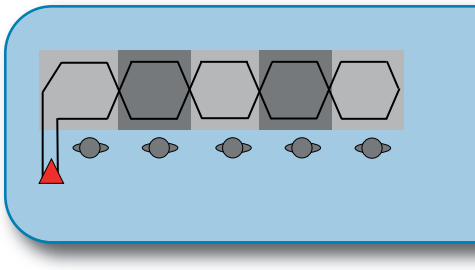
'Low overspill' phase-shifting loops

For applications where minimal overspill and consistent coverage throughout a site (i.e. no dead spots) is essential, consider using one of our DLR phase shifting dual induction loop amplifiers (page 23). Although a more costly and time-consuming method than the reduced sized loops described earlier it will avoid any dead spots being formed inside the loop and produce a much better signal quality. The method works by producing two AFILS signals that are 90° out of phase with each other. These signals are connected to two induction loops laid out in a special overlapping pattern (see right). The resultant magnetic field is evenly spread within the covered area and the field strength falls off very quickly outside the loop.



‘Low overspill’ fixed table loops

This pattern restricts the loop to the immediate vicinity of the table and, depending on the layout, there should be little or no overspill outside the room. The area of the loop is the overall length x the width, ignoring the shape of the pattern. The perimeter is the actual cable length and this may result in a larger cable diameter being required than for a rectangular loop.



Mains hum

Some buildings have an underlying 50Hz hum present, especially old properties where live and neutral wiring takes separate routes, resulting in a loop. However, most hearing aids are designed to reject such low frequencies, and so this is not normally a practical problem.

Interference

Induction loops will interfere with other equipment, i.e., electric guitars will definitely pick up the magnetic field and cause feedback although some are less sensitive. If listeners can hear a hum when the loop system is operating, turn the amplifier off completely and test for noise using a hearing aid or a loop listening device. The noise should still be present and proves it cannot be due to the loop amplifier. We recommend this be tested for before installation.

Damage to the loop

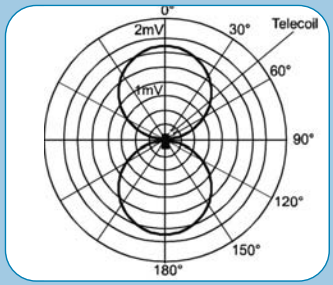
A simple break can be repaired provided it can be found. All that matters is that the join is low resistance and allows the required current to flow through the loop. If the loop cable is shorted to earth, for instance, by drilling through it and touching a reinforcing grid, the amplifier output stage will be damaged. This cannot be protected against.

The isolation issue

When a hearing aid user switches his or her hearing aid to the ‘T’ position, its on-board microphone is switched off and the only noise that can be heard is the loop signal. If the system is connected to just one sound source, such as a TV, some hearing aid users say the lack of background noise makes them feel isolated. This can be overcome by positioning a microphone where it will convey background noise and pick up general conversation - this can be easily achieved using our Outreach input extension system.

Vertical loops

Virtually all loops are laid in a horizontal position (as around the skirting board). This is due to the directional response of the hearing aid (see diagram right). However, in an application such as a hospital where the hearing aid wearer is predominantly lying down then no signal will be received. It is therefore necessary to run the loop cable at an angle of 45 degrees from floor to ceiling as this will allow the hearing aid to cut across the plane and receive a signal.



In summary...

Each induction loop system can bring with it its own set of problems and issues. Before designing a system, try to find answers to the following questions. Once you have the answers, the information in this guide will help you provide an effective solution.

- What is the area used for (reception, meeting room, lecture theatre, etc)?
- Do you require an audio input from a TV/Video?
- Do you require an input from an existing PA system?
- Do you require fixed or mobile microphones?
- Do any rooms next or close to the area require a separate system?
- What are the dimensions of the area - length, width and height?
- Where can the loop cable be installed - ceiling / floor void, in floor screed, under floor covering or wall?
- What is the ceiling height and how is it constructed?
- Is there any steel or other metals around the building?
- Does it need to be a 'secure' system with little overspill?

Free Training

SigNET can offer free-of-charge training to qualifying customers.

Our six-hour **AFILS Training Session** begins with our CPD certified 'Hearing Assistance Solutions: The Route to DDA/Equality Act Compliance' seminar whilst the remainder of the course gives a detailed overview of the PDA range of induction loop systems.

Ideal for installers, sales professionals, engineers and architects, the course covers: what the DDA/Equality Act recommends; how auxiliary aids such as sound reinforcement, infrared, radio and audio-frequency induction loop systems work; a history of the telecoil and induction loop systems; why loop systems are used and are useful; a detailed overview of the PDA RANGE of induction loop amplifiers, system testing to British standards; AFILS installation and low overspill loop designs. Please contact your distributor for details.

Testing an induction loop system

We recommend all induction loop systems are tested using our 'Fosmeter Pro' Induction Loop Test Kit (FPROK1).

Designed to simplify the setup of an induction loop system to the latest version of BS EN 60118-4 (Magnetic field strength in audio-frequency induction loops for hearing aid purposes), the kit includes an FPRO Fosmeter Pro induction loop tester c/w intuitive display and simple to follow test menus, a calibrated FPROSG Signal Generator c/w pre-loaded test tones and a set of headphones.

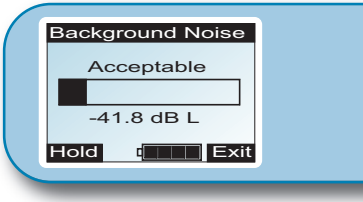
As well as checking the magnetic field strength of an induction loop system, it also measures background noise, frequency response, metal compensation and allows you to listen to the loop signal. The tester is powered from a 9V PP3 battery and is supplied in a protective canvas carrying case.

The test procedure

The test procedure is simplicity itself. First, connect the FPROSG signal generator to the loop amplifier via an appropriate connection lead (AL3 or AL14 - the lead used will depend on the system's loop amplifier). Next, set the signal generator to deliver one of three tones into the induction loop (the tone required is dependent on the test being carried out). Finally, carry out the appropriate test (explanations are below) using the Fosmeter Pro tester, log the results on the certificate provided and proceed to the next test until all tests are completed.

Background noise test

Designed to ensure the background noise level of the site/system does not affect the intelligibility of the system in the covered area by detecting the level of background noise and indicating if it is acceptable, tolerable or too high in accordance with BS EN 60118-4.

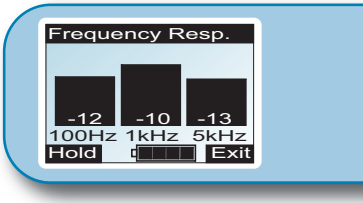


Field strength test

Designed to ensure the loop signal provides sufficient volume without distortion in the covered area by detecting a pulsed 1kHz signal in accordance with BS EN 60118-4, calibrated at 400mA/m (0 dB L).

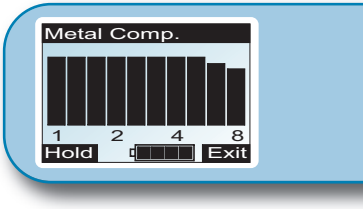
Frequency response test

Designed to ensure good speech intelligibility in the covered area by detecting 100 Hz, 1 kHz and 5 kHz in accordance with BS EN 60118-4. Acceptable results are +/- 3dB L from the central 1 kHz reference bar. If this cannot be achieved, use the amplifier's 'Metal Compensation' control (if fitted) until an acceptable range is displayed.



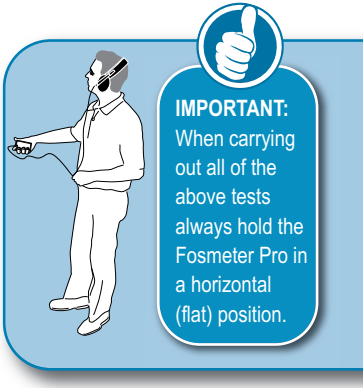
Metal compensation test

Designed to ensure losses due to building structure and furnishings do not cause poor signal quality at high audio frequencies in the covered area. Goes above and beyond the scope of BS EN 60118-4 but adheres to the recommended 3rd octave frequency spectrum advised in the standard.



Subjective listening test

Designed to ensure hearing aid users receive an undistorted and clear signal in the covered area from the system's actual inputs (music sources, microphones, etc). Requires a set of HEAD1 headphones plugged into the Fosmeter Pro's headphone socket (ideally a hearing aid user should also test the signal using his or her own hearing aid but this is not always possible). Music and speech tracks are provided on the signal generator if needed.



PDA range induction loop amplifiers & kits

PL1/K1	Portable induction loop kit (cardboard carry case)
PL1/K3	Portable induction loop kit (robust plastic carry case)
PL1/EUROAD	European Schuko Plug Adaptor for PL1, black, 7.5A
ML1/K	ML1 counter induction loop kit
PDA102C	PDA102 counter induction loop kit
DL50	DL50 50m² Domestic induction loop amplifier ONLY
DL50/K	DL50 50m² Domestic induction loop amplifier kit
PDA102L	PDA102 50m² Small room loop kit (tie/desk mic version)
PDA102R	PDA102 50m² Small room loop kit (omni-directional plated mic. version)
PDA102S	PDA102 50m² TV lounge loop kit
PDA200E	PDA200E 200m² wall-mounting induction loop amplifier ONLY
AKM1	PDA200E 200m² Meeting/seminar room loop kit (PDA200E amplifier, APM omni-directional mic plate)
AKM3	PDA200E 200m² Professional meeting/seminar room loop kit (PDA200E amplifier, PRO45 hanging ambient microphone)
AKL1	PDA200E 200m² Lecture room loop kit (PDA200E amplifier, AMT tie/desk mic, AML lectern mic, 2 x APJ plate)
AKT1	PDA200E 200m² TV / music lounge loop kit (PDA200E amplifier, AMH handheld mic, APS scart lead, APJ plate, APL plate)
AKR1	PDA200E 200m² Waiting room loop kit (PDA200E amplifier, APL plate)
AKU1	PDA200E 200m² Retail unit loop kit (PDA200E amplifier, AML lectern mic, APJ plate)
AKW1	PDA200E 200m² Place of worship loop kit 1 (PDA200E amplifier, AML lectern mic, APJ plate, APL plate)
AKW2/L	PDA200E 200m² Place of worship loop kit 2 (lavalier mic. version) (PDA200E amplifier, AMR/LA lavalier radio mic, APQM plate, 2 x APXM plates)
AKW2/H	PDA200E 200m² Place of worship loop kit 2 (handheld mic. version) (PDA200E amplifier, AMR/HA handheld radio mic, APQM plate, 2 x APXM plates)
AKH1/L	PDA200E 200m² Health and fitness club loop kit (lavalier mic. version) (PDA200E amplifier, AMR/LA lavalier radio mic, APQM plate, APL plate)
AKH1/H	PDA200E 200m² Health and fitness club loop kit (handheld mic. version) (PDA200E amplifier, AMR/HA handheld radio mic, APQM plate, APL plate)
PDA200/2	200m² free standing induction loop amplifier
PDA500/2	500m² free standing induction loop amplifier
PDA1000/2	1000m² free standing induction loop amplifier
PDA200/2/UL	2,150 sq.ft Professional Induction Loop Amplifier
PDA500/2/UL	3,380 sq.ft. Professional Induction Loop Amplifier
PDA1000/2/UL	9,680 sq.ft. Professional Induction Loop Amplifier
PDA/RM	19" rack mount kit for PDA-PRO Range amplifier
PDA/WM	Wall mount kit for PDA-PRO Range amplifier
DLR5	4U rack with dual phase-shifting induction loop amplifiers, for areas up to 200m²
DLR7	4U rack with dual phase-shifting induction loop amplifiers, for areas up to 500m²
DLR9	4U rack with dual phase-shifting induction loop amplifiers, for areas up to 1000m²
VL1/B1	1.2m² vehicle induction loop kit, 12V
VL1/B2	1.2m² vehicle induction loop kit, 24V
AKM2	PDA200E lift loop kit, for elevators

PDA range accessories

APJ	3.5mm mono jack outreach plate (takes AMT, AMH, AML or AMD mics)
APL	Line level audio outreach plate (takes APS SCART lead/other line level audio feeds)
APQM	6.35mm stereo jack outreach plate (takes AMR/L & AMR/H radio microphone kit)
APQL	6.35mm stereo jack outreach plate (takes line level feeds from mixing desks, etc)
APXM	XLR mic level outreach plate (takes AMP microphone)
APXL	XLR line level outreach plate (takes line level feeds from mixing desks, etc)
APM	Omni-directional plated microphone. Wall, ceiling or desk mountable
APXO	XLR balanced line output plate (connects Outreach chain to 3rd-party equipment)
API	AFILS active indicator light
APS	SCART to double phono lead (for use with APL plate)
APM	Omni-directional plated microphone. Wall, ceiling or desk mountable
AMT	Tie/desk mic. for ML1, PDA102, PDA200E, PL1, PDA-PRO or APJ plate
AMH	Handheld mic. for ML1, PDA102, PDA200E, PL1, PDA-PRO or APJ plate
AML	Lectern mic. for ML1, PDA102, PDA200E, PL1, PDA-PRO or APJ plate (275mm high)
AMLS	Lectern mic. (short stemmed version of AML, 175mm high)
AMD	Desktop mic. for ML1, PDA102, PDA200E, PL1, PDA-PRO or APJ plate (310mm high)
AMDS	Desktop mic. (short stemmed version of AMD, 215mm high)
AMD/P	Desktop mic. (push to talk)
AMP	Professional handheld mic. for PDA200E or APXM plate, requires AXLR lead
AMR/LA	Lavalier radio mic. kit c/w receiver, transmitter, PSU (4 selectable frequencies)
AMR/HA	Handheld radio mic. c/w receiver, transmitter, PSU (4 selectable frequencies)
PRO45	Hanging ambient mic. for PDA-PRO Range or APXM plate
LOOP1/W	100m x 0.5mm^2 single core white loop cable
LOOP2/W	100m x 1.0mm^2 single core white loop cable
LOOP3/W	100m x 1.5mm^2 single core white loop cable
LOOP4/W	100m x 2.5mm^2 single core white loop cable
FLAT1005	100m x 0.5mm^2 insulated copper tape (flat loop cable for under carpets)
FLAT2005	100m x 1.0 mm^2 insulated copper tape (flat loop cable for under carpets)
FLAT3005	100m x 1.5mm^2 insulated copper tape (flat loop cable for under carpets)
TAPE	50m white synthetic fibre tape (used to protect flat loop cable)
BELDEN/10	10m Belden 8723 two-pair screened cable for use with outreach plates
BELDEN/25	25m Belden 8723 two-pair screened cable for use with outreach plates
APT	Loop connector plate (for the termination of induction loop cable)
AXLR	XLR to XLR lead (used to connect AMP mic to APXM outreach plate)
LEST	100V line (i.e PA system output) to 0db (775mV line level) convertor
APPS	Overspill reduction phase shifter
TEAR-P	Spare 'AFILS available' sticker
TEAR10	Pack of 10 self-adhesive 'induction loop fitted' stickers
FPROK1	FosMeter-Pro Induction Loop Test Kit
FPROSG	Calibrated Audio Signal Generator c/w test tones
RXTI2	Induction loop listener, requires 2 x AAA batteries & walkman-type headphones
AL3	3.5mm jack to bare ended lead (connects FPROSG to PDA102, ML1, PDA200E)
AL14	Male XLRM to 3.5mm jack lead (connects FPROSG to PDA-PRO)

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