



# ASSISTIVE LISTENING SYSTEMS



## GETTING THE MESSAGE ACROSS



AUDIO-FREQUENCY HEARING LOOP SYSTEMS

PDA Range



INFRARED ASSISTIVE LISTENING SYSTEMS

ListenIR



THROUGH-COUNTER SPEECH TRANSFER SYSTEMS

OnPOINT



WIFI AUDIO STREAMING SOLUTIONS

ListenEVERYWHERE

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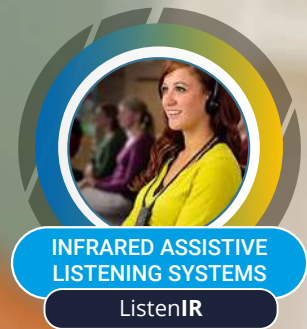
# What is an assistive listening system?

Assistive listening systems allow people with hearing impairment to hear more clearly and to participate more fully in general conversations, order goods or services and listen to public performances.

They can also be used in noisy environments to make sound more intelligible or in applications such as museum 'walk through' or surveillance systems.

The most popular types of assistive listening systems in the UK are hearing loop systems but other types are available including infrared, wifi streaming and through-counter speech transfer systems.

This guide explains how all of these systems work, where they are required and details the comprehensive range of assistive listening products available from us.



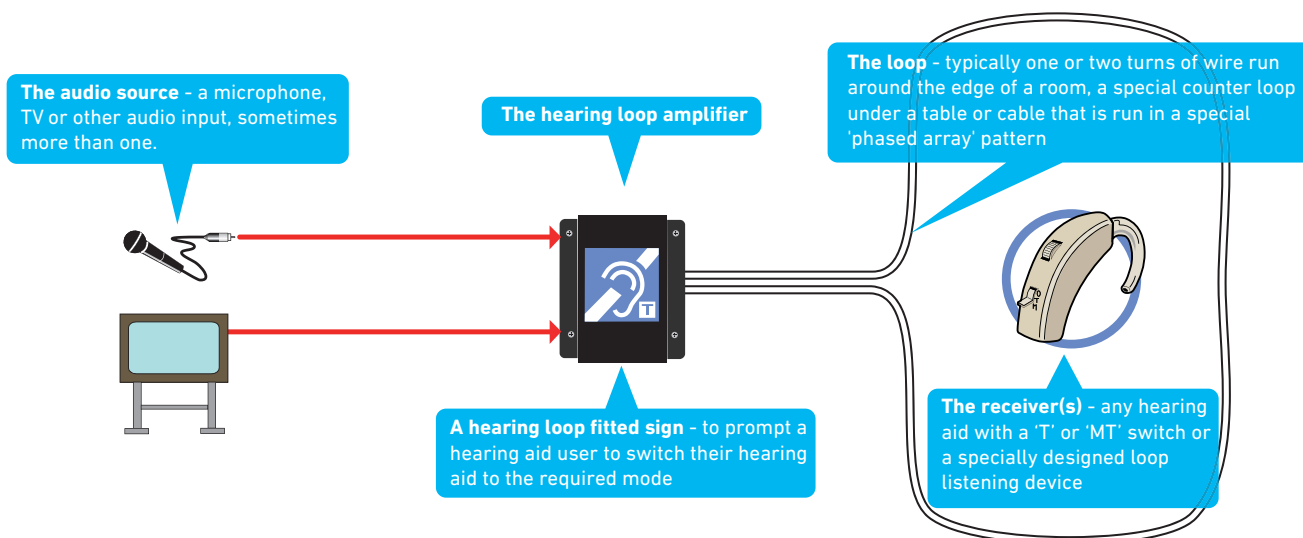
# Types of assistive listening systems

## HEARING LOOP SYSTEMS

Hearing loop systems work by broadcasting sound to hearing aids or special 'loop' receivers.

Most hearing aids have a switch or automatic sensor that allows them to pick up the electromagnetic field generated by a hearing loop system. The hearing aid converts this signal into a sound suited to its user's hearing requirements, allowing them to participate more effectively in general conversation, order goods or services, listen to public performances, etc

### A hearing loop system comprises:



### Hearing loop systems are popular because:-

- ▶ Unwanted sound such as background noise is not picked up.
- ▶ No special receivers are required - telecoils are fitted in most hearing aids. In other types of system special receivers may be required that the service provider must manage and maintain.
- ▶ Magnetic induction tends to be more reliable than, say, an infrared system which is line of sight only.
- ▶ Hearing aids amplify different bands by different amounts to suit a user's specific hearing requirements.
- ▶ Users do not have to reveal they are hearing impaired.

Hearing loop systems (also known as audio-frequency induction loop amplifiers or AFILS) do not use radio frequencies. Instead they operate at audio frequencies where the signal from an audio source is fed into a hearing 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 placed in or around the room using a constant current amplifier

The current flowing through the loop generates a magnetic field that radiates in the space around the loop cable. Any lines of magnetic flux that pass through a hearing aid's telecoil 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 note the magnetic field will 'bleed' outside the perimeter of the loop so a loop system cannot be considered confidential. Ways of reducing this overspill and to create a secure loop system for say, a courtroom, are addressed later in this document.

# Types of assistive listening systems

## INFRARED (IR) SYSTEMS

An Infrared (IR) assistive listening system transmits sound over infrared (electromagnetic radiation with a wavelength just above the red end of the visible light spectrum) to compatible receiving devices without amplifying ambient noise.

Such systems typically comprise:-

- An audio source such as a microphone or PA system.
- A mixer - to generate a line level input from the audio source(s)
- A modulator and radiator - to transmit the IR signal
- An infrared receiver c/w a neck loop allowing the listener to access the infrared signal

Although they tend to be more expensive than hearing loop systems and also require the supply, management and maintenance of custom IR receivers, advantages of IR systems include excellent sound quality and no field wiring is required (making them ideal for areas where

laying hearing loop cable may be impractical such as in listed buildings). In addition, their 'line of sight' operation is good for privacy in areas such as courtrooms.



For more details see page 30

## THROUGH-COUNTER SPEECH TRANSFER SYSTEMS

"Through-counter" speech transfer systems are effectively window intercom systems that help make ticket counters, reception desks and other areas with a perspex or glazed screen more accessible.

They typically comprise an internal and external window intercom with different 'scene' settings to suit different types of office and public environments (such as noisy, standard or quiet).

The advantages of a speech transfer system include allowing social distancing to be maintained by making conversations easier and optional pairing of the system to a hearing loop amplifier allowing the audio signal to be broadcast directly to a compatible hearing aid.



For more details see page 29

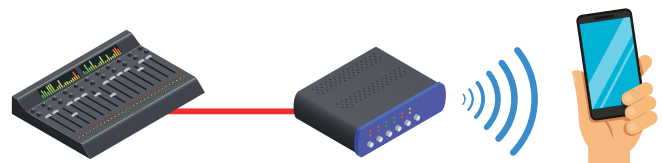
## WIFI STREAMING SYSTEMS

WiFi assistive listening systems are relatively new but the concept behind them is quite simple.

Sound is transmitted from an audio source to a local area network WiFi system that can be accessed via a Smartphone. Sound is then delivered from the Smartphone to the ear via a headset.

The advantages of a WiFi streaming system are that Smartphones are extensively used and multi-channel systems allow multiple input choices allowing, say, different football game commentaries to be offered in a sports bar.

Downsides of WiFi systems are that there can be significant latency (delay time) between voice and ear and an App needs to be downloaded and activated by the user which some older people or people with certain disabilities may find difficult.



For more details see page 32

# Where are assistive listening systems required?

## According to the Royal National Institute for the Deaf (RNID), in the UK:-

- Approximately 12 million adults (1 in 5 of the population) are deaf or hard of hearing.
- At least 50,000 children are deaf.
- By 2035, there will be 14.2 million adults affected by hearing loss.
- An estimated 2 million people use hearing aids and approx. 6.7 million could benefit from them.

Lobbying by organisations such as the RNID has led to increased awareness of the difficulties faced by the hearing impaired and today numerous Standards, Acts and Schemes recommend the provision of auxiliary aids 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 can be purchased or viewed from the organisations and/or websites indicated:-

## The Equality Act (2010)



The Equality Act aims to protect disabled people including the hearing impaired. Under the Act (which combines and replaces previous legislation including the Disability Discrimination Act), all service providers and those providing goods and facilities in England, Wales and Scotland are required to make changes, where needed, to improve service

for disabled 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, a hearing loop for customers with hearing aids, special computer software or additional staff support when using a service etc). 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](http://www.gov.uk/government/organisations/government-equalities-office) Similar, but separate, guidance applies to Northern Ireland and can be found at: [www.equalityni.org/Legislation](http://www.equalityni.org/Legislation)

## Building Regulations Part M1: Access and use of buildings other than dwellings (2015)



Current building regulations for England 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 hearing 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 hearing loop system would be acceptable.

- Building Regs, Part M1 can be viewed at <https://www.gov.uk/government/collections/approved-documents>. For Wales, visit [www.gov.wales/building-regulations-approved-documents](http://www.gov.wales/building-regulations-approved-documents). For Scotland, visit [www.gov.scot/policies/building-standards-monitoring-improving-building-regulations/](http://www.gov.scot/policies/building-standards-monitoring-improving-building-regulations/)

## BS 8300-1 & 2 (2018) : Code of practice for the design of an accessible and inclusive built environment



In 2018, BS 8300 (2009) was superseded by two new codes of practice. BS 8300-1 is the code for external environments and BS 8300-2 is the code for the design of buildings to accommodate users with the widest range of characteristics

# Where are assistive listening systems required?

and capabilities to achieve an inclusive environment. These standards do not just refer to specifically designing a building for disabled people anymore but give recommendations on how buildings should be designed for use by all people.

BS 8300-2 includes Annex D which directly refers to the implementation of Hearing Loop Systems in buildings. It covers all manner of the installation of hearing loops in different types of buildings, from specification to best practice installation, maintenance and use.

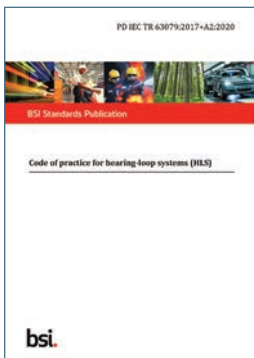
The standard recommends that "an assistive listening system, using induction loop, infrared or radio transmission, should be installed in rooms and spaces used for meetings, lectures, classes, performances, spectator sport or films, and at help and information points and service or reception counters where the background noise level is not low or where glazed screens are used. Induction loop systems should meet the recommendations given in BS 7594" (now PD IEC TR 63079). 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.

It also says buildings should include locations where announcements can be transmitted through a hearing loop system, with graphical signs to inform people where they are fitted (section 12.1.4).

Table D.1 of BS 8300-2 gives examples of where hearing loop systems are used, including 'counter loops' on bank counters, supermarket checkouts, retail points and reception desks and 'integrated loops' on help points and door entry systems and at disabled refuge points.

• Copies are purchasable from <https://shop.bsigroup.com>

## PD IEC TR 63079: 2017 + A2:2020: Code of practice for hearing-loop systems



This relatively new international standard/technical report gives guidance and recommendations on the design, planning, installation, testing, operation and maintenance of a hearing loop system intended for communicating speech, music and/or other signals. It is

primarily concerned with hearing loop systems used for hearing enhancement communicated to users of hearing

aids equipped with magnetic induction. It effectively replaces BS 7594 (the UK code of practice for audio-frequency hearing loop systems) which was withdrawn in 2020. It also recommends loop systems are designed and installed by a trained specialist - for details on our free training courses see page 34

• Copies are purchasable from <https://shop.bsigroup.com>

## BS EN 60118-4: 2015+A1:2018 (Induction loop systems for hearing aid purposes – system performance requirements)

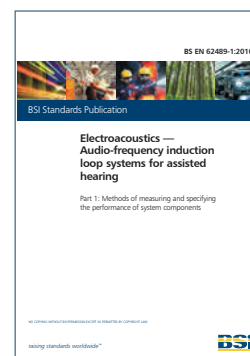


This standard gives performance requirements for hearing loop systems producing a magnetic field for hearing aids using telecoils to pick it up. It sets out the requirements for the magnetic field strength to be delivered across the entire listening area, including the minimum frequency output for acceptable intelligibility. Also

included are methods for testing the field strength, measurement techniques and information regarding the setting up and use of the system for the end user.

• Copies are purchasable from <https://shop.bsigroup.com>

## BS EN 62489-1:2010 + A2:2018 (Electroacoustics – Audio-frequency induction loop systems for assisted hearing – Methods of measuring and specifying the performance of system components)



This standard covers the performance requirements of the components of a hearing loop system, including type testing of amplifiers, microphones and other appliances, such as playback equipment. Its aim is to ensure that manufacturers

of hearing loop equipment create products that follow a similar specification, which can be verified by various performance tests set out by the standard.

• Copies are purchasable from <https://shop.bsigroup.com>

**This guide (the one you are reading) provides basic advice on how to meet the above guidelines/standards**

# PDA RANGE

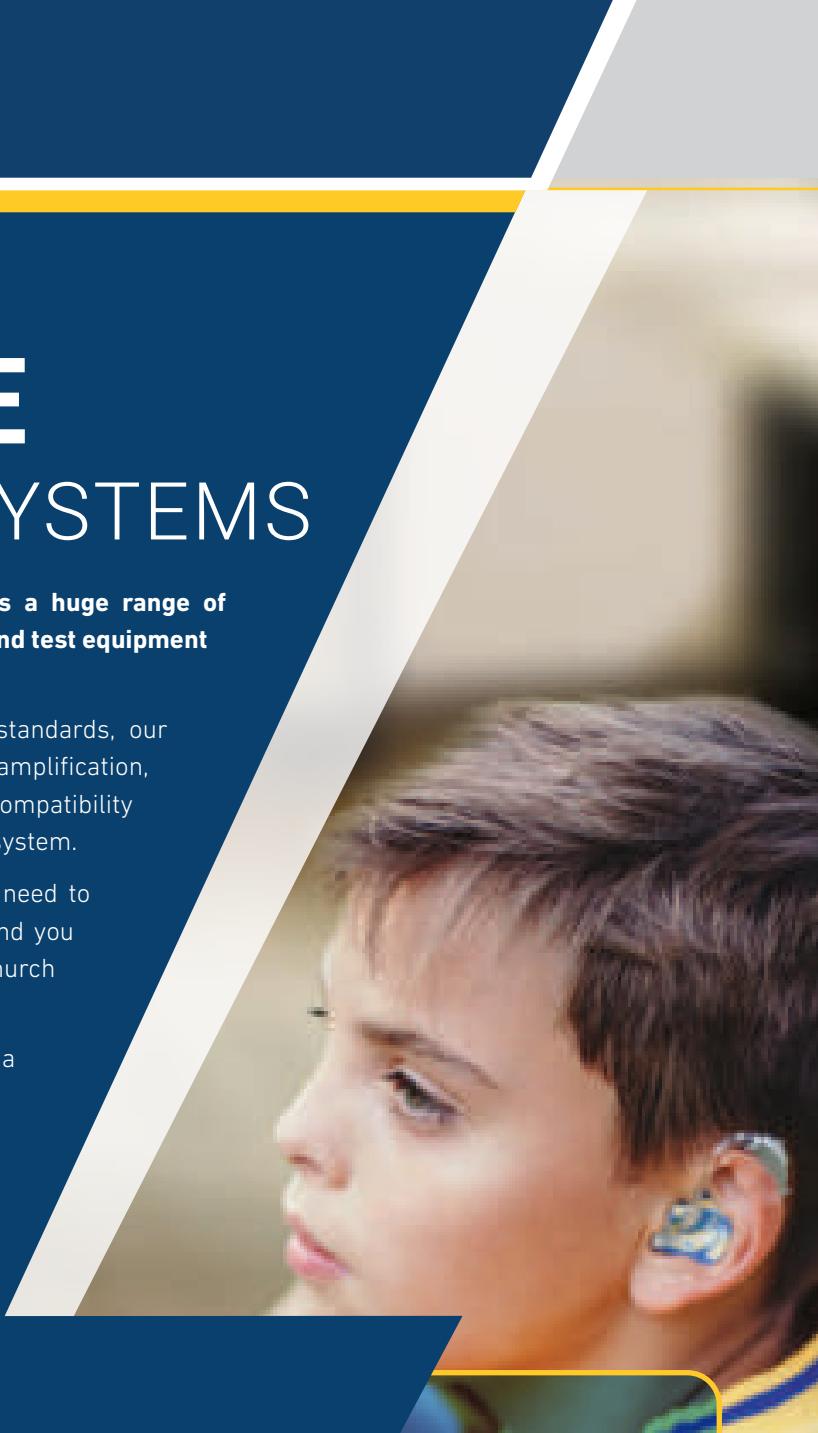
## HEARING LOOP SYSTEMS

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

Designed to exceed the requirements of all relevant standards, our amplifiers offer excellent intelligibility, true current mode amplification, 'phantom' power (for use with electret microphones) and compatibility with our innovative Outreach plate audio input extension system.

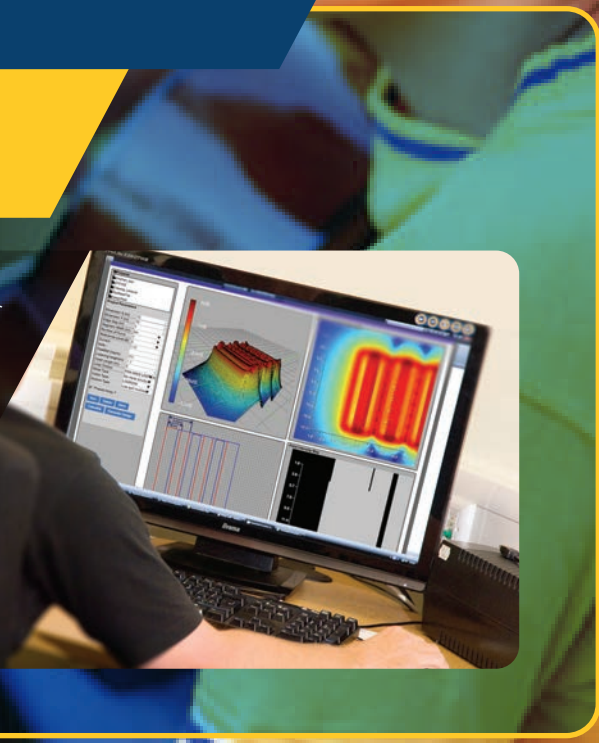
Before deciding which hearing loop system to use, you need to ascertain the size of the area to be covered. Bear in mind you may not need to cover all of an area, for example in a church only the pews may require coverage.

You should be able to ascertain the best equipment for a system using the information in this document and the questions you should ask before starting a design or installation are listed on page 27.



### System Design Assistance

To assist system designers and installers in selecting the best amplifier and loop cable for a particular application, we have produced an easy to use loop design software tool that can be downloaded from our website (registration required). By inputting data such as loop dimensions, metal content and loop type, you will be able to discover which PDA range amplifier and loop cable will work best for you. The software accurately predicts field strength and overspill using 3D and 2D modelling and has simple drop-down menus allow you to select between perimeter and phased array loop patterns

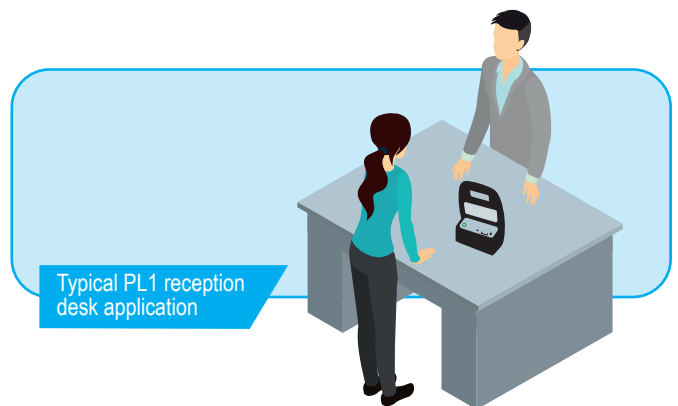




## 1.2m<sup>2</sup> Portable Hearing Loop System

### Key Features

- ▶ Ideal for restricted person to person contact in areas such as small meeting rooms and open plan offices.
- ▶ Portable, lightweight design means the system can be moved easily from location to location.
- ▶ Simple one button operation.
- ▶ Integral high performance microphone.
- ▶ Excellent sound quality.
- ▶ 5 years' battery life under normal operating conditions.
- ▶ Auto shut-off facility (user selectable for 10, 30 or 60 minutes) helps preserve battery life.
- ▶ Connection of the plug-top charger overrides the timer function to ensure the PL1 is operational at all times.
- ▶ Two kitted versions available - the PL1/K1 with a robust wall-mounting storage shelf and the PL1/K3 without a storage shelf but supplied in a durable plastic carry case.



### At-a-glance specifications

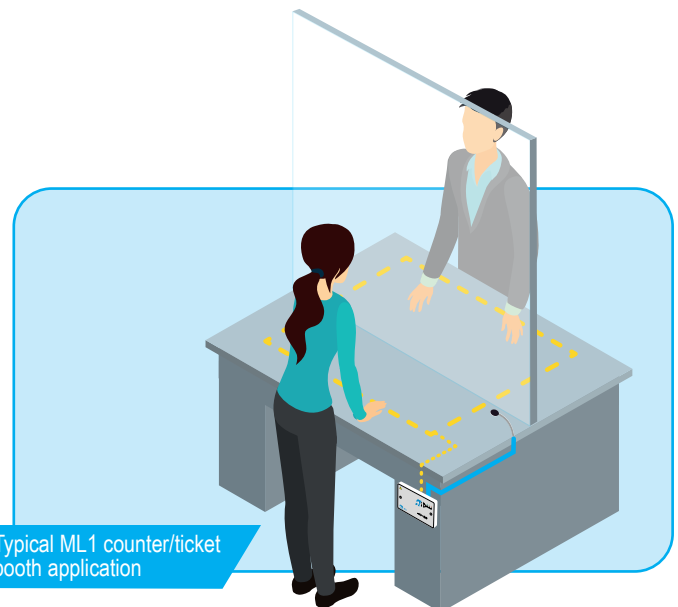
<b>TYPE</b>	Portable (A1)
<b>COVERAGE</b>	1.2m <sup>2</sup> approx.
<b>DIMENSIONS &amp; WEIGHT</b>	W 271 x H 200 x D 77mm / 2.82kg (amplifier); W 260 x H 263 x D 140mm / 360g (shelf)
<b>CONSTRUCTION &amp; FINISH</b>	Black plastic IP20 rated amplifier with blue 'AFILS' available label; black high impact polystyrene shelf.
<b>INPUTS</b>	2 x Mic (one built-in mic. and one 3.5mm remote mic. socket for AMT or AMD mics)
<b>INDICATORS</b>	Power on; input level; charging required; charging in progress, audio warning of imminent shutdown
<b>CONTROLS</b>	On/off button; adjust auto-shut off timer
<b>KIT VARIANTS</b>	PL1/K1 : PL1 amplifier, plugtop charger, storage shelf, 'AFILS available' sticker, cardboard carry case. PL1/K3 : PL1 amplifier, plugtop charger, 'AFILS available' sticker, robust plastic carry case.

# ML1/K

## 1.2m<sup>2</sup> Counter Hearing Loop System

### Key Features

- ▶ 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 - the ML1/K can be fitted by any competent electrician.
- ▶ Space-saving double-gang wall-mounting amplifier fits standard UK 25mm back boxes (requires fixed mains wiring).
- ▶ Includes a separate omni-directional AMT microphone that plugs directly into the 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.
- ▶ In addition to being used as a 1.2m<sup>2</sup> counter loop system, the ML1 amplifier is capable of covering larger reception desks up to 20m<sup>2</sup> (approx. 4.4 x 4.4 metres) using a loop made from standard four core security alarm cable wired as four turns.
- ▶ Exceeds the requirements of PD IEC TR 63079 & EN60118-4 when correctly installed.

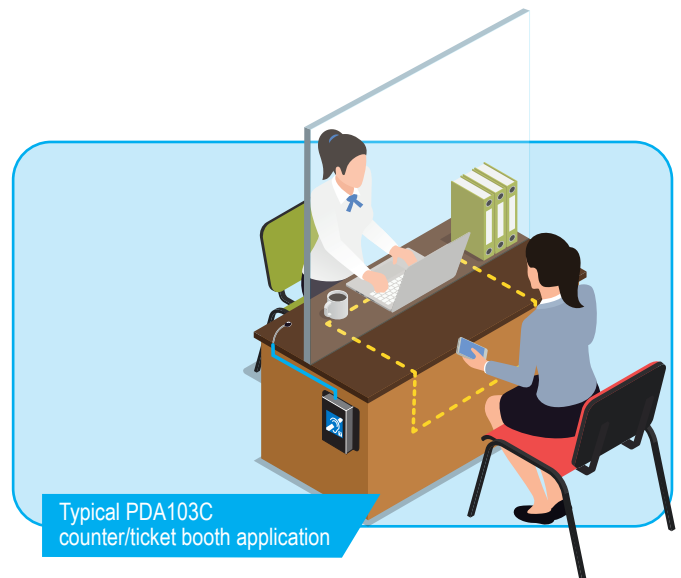


### At-a-glance specifications

<b>TYPE</b>	Small Volume (A2). Wall mounting (requires fixed mains wiring and a 25mm back box)
<b>COVERAGE</b>	1.2m <sup>2</sup> approx.
<b>DIMENSIONS &amp; WEIGHT</b>	W 143 x H 83 x D 32mm / 300g (amplifier only)
<b>CONSTRUCTION &amp; FINISH</b>	Plastic IP20.
<b>INPUTS</b>	1 x 3.5mm remote mic. socket; 1 x Line/Outreach socket (max. 3 Outreach plates per ML1)
<b>INDICATORS</b>	Input level; power on; loop drive meter.
<b>CONTROLS</b>	Mic. input level, line input level; loop drive
<b>KIT CONTENTS</b>	ML1 Amplifier, AMT microphone, TX2 pre-formed counter loop; 'Hearing Loop Fitted' sticker.

### Key Features

- ▶ Everything you need to create a high-quality fixed hearing loop system for a counter, desktop or ticket booth.
- ▶ Ideal for banks, post offices, reception desks, ticket offices and any other area requiring restricted person to person coverage.
- ▶ PDA103 amplifier includes a 3.5mm microphone input (for use with the AMT microphone supplied), a line level input and an 'outreach' socket
- ▶ Metal compensation control helps improve intelligibility in rooms with high metal content.
- ▶ Adjustable mic, line level and 'outreach' controls.
- ▶ Drive (level) control allows the amplifier's output stage to be set-up to suit the exact characteristics of the application.
- ▶ State-of-the-art audio processor features an automatic gain control which compensates for poor microphone techniques and helps suppress loud noises, hisses & clicks.
- ▶ Can be wall-mounted using the keyholes provided.
- ▶ Exceeds the requirements of PD IEC TR 63079 & EN60118-4 when correctly installed.



### At-a-glance specifications

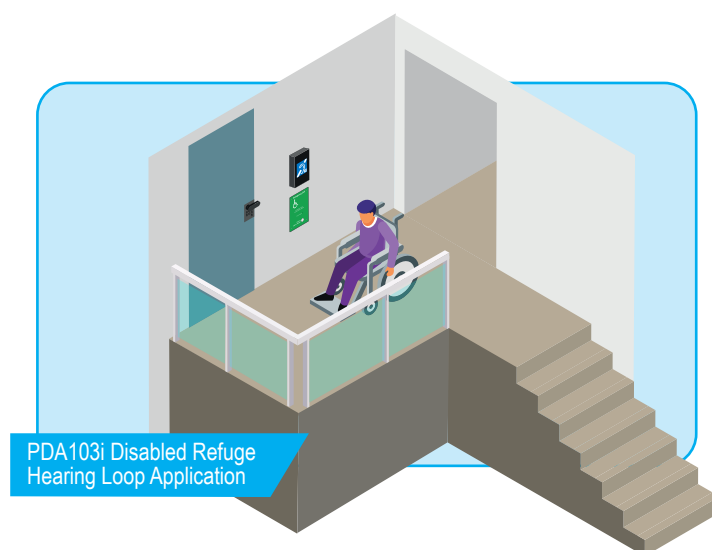
<b>TYPE</b>	Small Volume (A2). Free-standing/wall mountable. Plugtop mains lead supplied
<b>COVERAGE</b>	1.2m <sup>2</sup> approx.
<b>DIMENSIONS &amp; WEIGHT</b>	W 135 x H 130 x D 35mm / 380g (amplifier only); W 340 x H 250 x D 73mm (kit box).
<b>CONSTRUCTION &amp; FINISH</b>	Black metal, IP40.
<b>INPUTS</b>	1 x 3.5mm remote mic. socket; 1 x 3.5mm line socket; 1 x Outreach socket
<b>INDICATORS</b>	Limit, Peak, Loop Fault and Power On
<b>CONTROLS</b>	Mic; Line; Outreach; Metal Compensation (all individually adjustable) and Loop Drive (Level)
<b>KIT CONTENTS</b>	PDA103 amplifier; PL1/PSU1 plugtop power supply; AMT microphone; TX2 pre-formed counter loop; 'Hearing Loop Fitted' sticker.

# PDA103i

## 1.2m<sup>2</sup> Refuge/Intercom Hearing Loop System

### Key Features

- ▶ A self-contained hearing loop system specifically designed to easily integrate with disabled refuge, door entry and intercom help points.
- ▶ Helps satisfy the integrated loop requirements of BS 8300
- ▶ Housed in an attractive surface-mounting waterproof enclosure that is ideal for use in indoor or outdoor areas.
- ▶ Supplied with a plugtop power supply (if no plug socket is available, replace with an appropriate 110-240Vac @ 50/60Hz Mains power supply)
- ▶ Adjustable controls allow the amplifier's input and output stages to be set to suit the exact characteristics of the application.
- ▶ State-of-the-art audio processor helps suppress loud noises, hisses & clicks
- ▶ Includes internal Limit, Peak, Loop Fault and Power On indicators
- ▶ Exceeds the requirements of PD IEC TR 63079 & EN60118-4 when correctly installed.



### At-a-glance specifications

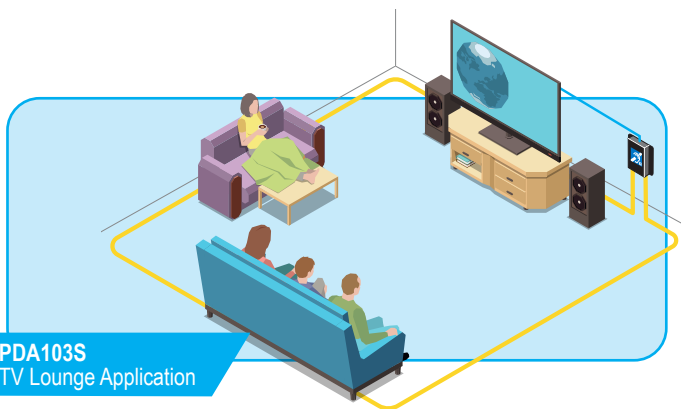
<b>TYPE</b>	Small Volume (A2). Wall mountable. Plugtop mains lead supplied
<b>COVERAGE</b>	1.2m <sup>2</sup> approx..
<b>DIMENSIONS &amp; WEIGHT</b>	W 220 x H 290 x D 100mm / 800g (amplifier)
<b>CONSTRUCTION &amp; FINISH</b>	Black plastic, IP65
<b>INPUTS</b>	1 x 3.5mm remote mic. socket; 1 x 3.5mm line socket; 1 x Outreach socket
<b>INDICATORS (INTERNAL)</b>	Limit; Peak; Loop Fault; Power On.
<b>CONTROLS (INTERNAL)</b>	Mic; Line; Outreach; Metal Compensation (all individually adjustable) and Loop Drive (Level).

# PDA103L/R/S

## 50m<sup>2</sup> Small Room Hearing Loop Systems

### Key Features

- ▶ Three wall-mountable hearing loop kits for use in rooms up to 7m x 7m (in areas over 5m wide with high metal content consider using a phased array loop system instead, see pages 18 & 19).
- ▶ PDA103R & L ideal for meeting rooms. PDA103S ideal for TV lounges. See kit contents below.
- ▶ Amplifier includes a 3.5mm mic input, line level input & 'outreach' socket (PDA103S also has a digital TOS link connector for TV set connection)
- ▶ Adjustable mic, line level, metal compensation and 'outreach' controls.
- ▶ Drive control allows the output stage to be set up to suit the characteristics of the application.
- ▶ State-of-the-art audio processor with automatic gain control
- ▶ Limit, Peak, Loop Fault and Power On indicators,
- ▶ Exceeds the requirements of PD IEC TR 63079 & EN60118-4 when correctly installed.

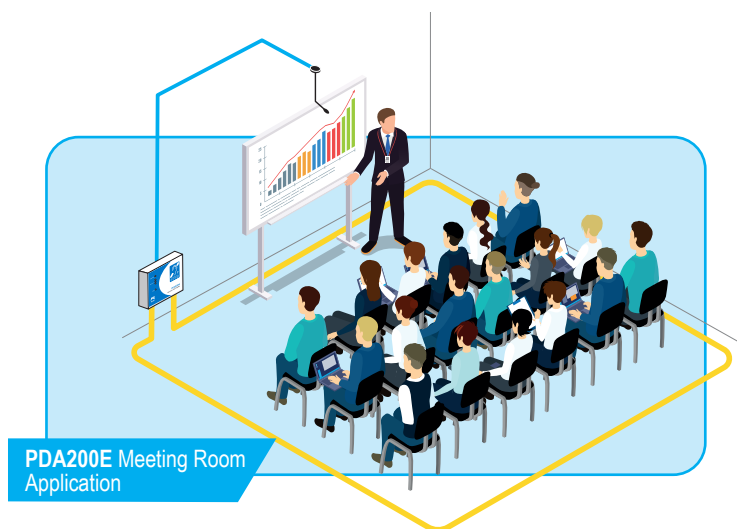


### At-a-glance specifications

<b>TYPE</b>	Perimeter (A3). Free-standing/wall mountable. Plugtop mains lead supplied
<b>COVERAGE</b>	1.2m <sup>2</sup> approx.
<b>DIMENSIONS &amp; WEIGHT</b>	W 136 x H 56 x D 178mm / 1.25Kg (amplifier). W x 340 x H 250 x D 73mm (Kit Box).
<b>CONSTRUCTION &amp; FINISH</b>	Black metal, IP40.
<b>INPUTS</b>	1 x 3.5mm remote mic. socket; 1 x 3.5mm line socket; 1 x Outreach socket
<b>INDICATORS</b>	Limit, Peak, Loop Fault and Power On
<b>CONTROLS</b>	Mic; Line; Outreach; Metal Compensation (all individually adjustable) and Loop Drive (Level)
<b>KIT VARIANTS</b>	PDA103L Small Room tie/desk mic. kit: PDA103 amp; AMT mic; 40m loop cable; 'AFILS fitted' sticker PDA103R Small Room plated mic. kit: PDA103 amp; APM mic; 40m loop cable; 'AFILS fitted' sticker PDA103S TV lounge kit: PDA103 amp; APL dual phono outreach plate, 40m loop cable; 'AFILS fitted' sticker.

### Key Features

- ▶ The PDA200E is a wall-mounting hearing loop amplifier that can drive a perimeter loop of up to 200m<sup>2</sup> (14m x 14m) in free space/areas with low metal content.
- ▶ Internal drive, level & metal compensation controls.
- ▶ Two balanced / unbalanced line level inputs.
- ▶ One microphone input with 12V phantom power
- ▶ Outreach connector allows up to 10 of our audio input utility plates to be added - see page 22/23.
- ▶ Automatic compressor-limiter maintains the loop signal for improved intelligibility
- ▶ Each input has a separate internal tamper-resistant control that can be manually adjusted
- ▶ Compression, output (Peak Current 3, 2, 1) and power on (Power) front panel indicators
- ▶ Short circuit protection
- ▶ Internal temperature safety cut-out to stop over heating
- ▶ Wall-mounted metal enclosure for a permanent robust installation
- ▶ Exceeds the requirements of PD IEC TR 63079 & EN60118-4 when correctly installed.
- ▶ Also available in a variety of 'AK' Range kits for use in churches, waiting rooms, health and fitness suites, TV lounges, retail units, elevators and more.
- ▶ In areas over 5m wide with high metal content consider using a phased array loop system instead, see pages 18/19.



PDA200E Meeting Room Application

### At-a-glance specifications

<b>TYPE</b>	Perimeter (A3). Wall mounting, requires fixed mains wiring
<b>COVERAGE</b>	200m <sup>2</sup> approx.
<b>DIMENSIONS &amp; WEIGHT</b>	W 273 x H 200 x D 77mm / 2.82kg (amplifier only)
<b>CONSTRUCTION &amp; FINISH</b>	White painted steel (PDA200E amplifier), IP20
<b>INPUTS</b>	1 x 3.5mm remote mic. socket; 1 x Line/Outreach socket
<b>INDICATORS</b>	Input level; Power; Compression; Peak Current (3,2,1)
<b>CONTROLS</b>	Metal Compensation, Input level, loop drive
<b>KIT VARIANTS</b>	See page 15

# AK/PDA200E 200m<sup>2</sup> Hearing Loop Amplifier & Kits



**AKM1 Meeting/Seminar Room Hearing Loop Kit**  
PDA200E hearing loop amplifier  
APM omni-directional plated microphone  
6m of Belden cable



**AKH1/L Health & Fitness Club Hearing Loop Kit (lavalier radio mic. version)**  
PDA200E hearing loop amplifier  
AMR/LA lavalier radio microphone  
APJ outreach plate  
APXL outreach plate  
AL5 XLRM to XLRF balanced lead  
2 x 6m Belden cable



**AKM3 Professional Meeting/Seminar Room Hearing Loop Kit**  
PDA200E hearing loop amplifier  
PRO45 hanging ambient microphone  
APXM outreach plate  
6m Belden cable



**AKH1/H Health & Fitness Club Hearing Loop Kit (handheld radio mic. version)**  
PDA200E hearing loop amplifier  
AMR/HA handheld radio microphone  
APJ outreach plate  
APL outreach plate (audio input for CD/tape deck)  
AL13 6.35mm jack lead  
AL6 3.5mm to 6.35mm converter plug  
2 x 6m Belden cable



**AKL1 Lecture Room Hearing Loop Kit**  
PDA200E hearing loop amplifier  
AMT tie/desk microphone  
AML lectern microphone  
2 x APJ 3.5mm jack input plates  
2 x 6m Belden cable



**AKW2/L Place of Worship Hearing Loop Kit (lavalier radio mic. version)**  
PDA200E hearing loop amplifier  
AMR/LA lavalier radio microphone  
APJ outreach plate  
APXL outreach plate  
AL5 XLRM to XLRF balanced lead  
2 x 6m Belden cable



**AKL2 Professional Lecture Room Hearing Loop Kit**  
PDA200E hearing loop amplifier  
2 x AMC cardioid ceiling microphones  
2 x APXM outreach plate  
2 x 6m of Belden cable



**AKW2/H Place of Worship Hearing Loop Kit (handheld radio mic. version)**  
PDA200E hearing loop amplifier  
AMR/HA handheld radio microphone  
APJ outreach plate (audio input for CD/tape deck)  
APXL outreach plate  
AL5 XLRM to XLRF balanced lead  
2 x 6m Belden cable



**AKW1 Place of Worship Hearing Loop Kit (fixed lectern mic version)**  
PDA200E hearing loop amplifier  
AML lectern microphone  
APJ 3.5mm jack input plate  
APL line level audio input plate  
2 x 6m of Belden cable

Note loop cable is NOT included in our AK Range kits

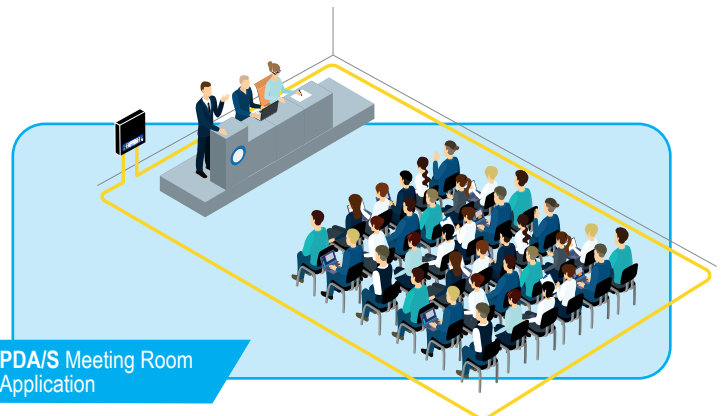
# PDA/S 200m<sup>2</sup>-1000m<sup>2</sup> Hearing Loop Amplifiers (LED Interface)

## Key Features

- ▶ A range of high-performing constant current hearing loop amplifiers with Class D output stages
- ▶ Intuitive LED interface allows simple set-up of input levels, output current & metal compensation
- ▶ Ideal for theatres, churches, conference halls etc where top quality sound is essential. In areas over 5m wide with high metal content consider using a phased array loop system instead, see pages 18/19.
- ▶ 1 x mic. input and 1 x line input
- ▶ Outreach connector allows up to 10 of our audio input utility plates to be added - see pages 22/23.
- ▶ Dedicated wall-mount and free-standing options
- ▶ Anti-tamper lock function
- ▶ Superior analogue audio processing provides life-like speech and first class music reproduction
- ▶ Fault relay & intuitive user interface provide clear indication of operation and fault status
- ▶ Industry leading dual action automatic gain control compensates for poor microphone technique
- ▶ Metal compensation control offsets the frequency response problems caused by excessive metal
- ▶ Line level output for recording or daisy-chaining multiple units to cover larger areas
- ▶ Exceeds the requirements of PD IEC TR 63079 & EN60118-4 when correctly installed and complies with EN62368-1



CLEAR & INTUITIVE LED INTERFACE



PDA/S Meeting Room Application

## At-a-glance specifications

<b>TYPE</b>	Perimeter (A3). Free standing (PDA5/SD, PDA7/SD, PDA11/SD) or wall-mounting (PDA5/SW, PDA7/SW, PDA11/SW)
<b>COVERAGE</b>	200m <sup>2</sup> (PDA5/SD, PDA5/SW), 500m <sup>2</sup> (PDA7/SD, PDA7/SW), 1000m <sup>2</sup> (PDA11/SD, PDA11/SW)
<b>DIMENSIONS &amp; WEIGHT</b>	W 218 x H 67 D 280mm (PDA5/SD, PDA7/SD, PDA11/SD); W 308 x H 298 x D 74mm (PDA5/SW, PDA7/SW, PDA11/SW)
<b>CONSTRUCTION &amp; FINISH</b>	Mild steel zintec, 1mm thick, black powder coated, IP40
<b>INPUTS</b>	1 x mic with switchable 12V phantom power, 1 x line & 1 x Outreach connector
<b>INDICATORS</b>	LED display with level, peak & limit indicators, Mic, 12V, Line, Metal, Outreach, Lock, Loop, Fault, Hot & Power
<b>CONTROLS</b>	Line Input, Microphone, 12V Phantom, Outreach, Metal Comp, Loop Drive.
<b>MODEL VARIANTS</b>	PDA5/SD 200m <sup>2</sup> Free-Standing Hearing Loop Amplifier, 4.75 Amp PDA5/SW 200m <sup>2</sup> Wall-Mount Hearing Loop Amplifier, 4.75 Amp PDA7/SD 500m <sup>2</sup> Free-Standing Hearing Loop Amplifier, 7.5 Amp PDA7/SW 500m <sup>2</sup> Wall-Mount Hearing Loop Amplifier, 7.5 Amp PDA11/SD 1000m <sup>2</sup> Free-Standing Hearing Loop Amplifier, 11 Amp PDA11/SW 1000m <sup>2</sup> Wall-Mount, Hearing Loop Amplifier, 11 Amp. PDA/RM3 Optional 19 inch rack mount kit for use with free-standing amplifiers



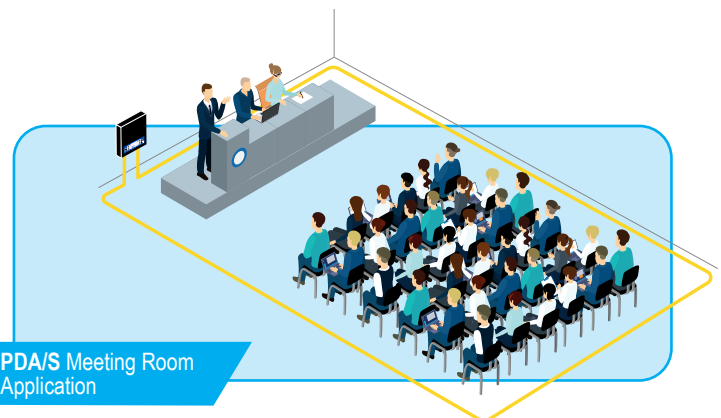
# PRO/S 200m<sup>2</sup>-1000m<sup>2</sup> Hearing Loop Amplifiers (Graphical Interface)

## Key Features

- ▶ A range of high-performing constant current hearing loop amplifiers with Class D output stages
- ▶ Intuitive graphical interface allows simple set-up of input levels, output current & metal compensation
- ▶ Ideal for theatres, churches, conference halls etc where top quality sound is essential. In areas over 5m wide with high metal content consider using a phased array loop system instead, see pages 18/19.
- ▶ 1 x mic. input and 1 x line input
- ▶ Outreach connector allows up to 10 of our audio input utility plates to be added - see pages 22/23.
- ▶ Dedicated wall-mount and free-standing options
- ▶ Anti-tamper lock function
- ▶ Superior analogue audio processing provides life-like speech and first class music reproduction
- ▶ Fault relay & intuitive user interface provide clear indication of operation and fault status
- ▶ Industry leading dual action automatic gain control compensates for poor microphone technique
- ▶ Metal compensation control offsets the frequency response problems caused by excessive metal
- ▶ Line level output for recording or daisy-chaining multiple units to cover larger areas
- ▶ Exceeds the requirements of PD IEC TR 63079 & EN60118-4 when correctly installed and complies with EN62368-1



HIGH CONTRAST EASY-TO-USE GRAPHICAL DISPLAY



PDA/S Meeting Room Application

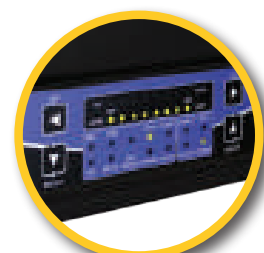
## At-a-glance specifications

<b>TYPE</b>	Perimeter (A3). Free standing (PRO5/SD, PDA7/SD, PDA11/SD) or wall-mounting (PDA5/SW, PDA7/SW, PDA11/SW)
<b>COVERAGE</b>	200m <sup>2</sup> (PRO5/SD, PRO5/SW), 500m <sup>2</sup> (PRO7/SD, PRO7/SW), 1000m <sup>2</sup> (PRO11/SD, PRO11/SW)
<b>DIMENSIONS &amp; WEIGHT</b>	W 218 x H 67 D 280mm (PRO5/SD, PRO7/SD, PRO11/SD); W 308 x H 298 x D 74mm (PRO5/SW, PRO7/SW, PRO11/SW)
<b>CONSTRUCTION &amp; FINISH</b>	Mild steel zintec, 1mm thick, black powder coated, IP40
<b>INPUTS</b>	1 x mic with switchable 12V phantom power, 1 x line & 1 x Outreach connector
<b>INDICATORS</b>	LED display with level, peak & limit indicators, Mic, 12V, Line, Metal, Outreach, Lock, Loop, Fault, Hot & Power
<b>CONTROLS</b>	Line Input, Microphone, 12V Phantom, Outreach, Metal Comp, Loop Drive.
<b>MODEL VARIANTS</b>	PRO5/SD 200m <sup>2</sup> Free-Standing Hearing Loop Amplifier, 4.75 Amp PRO5/SW 200m <sup>2</sup> Wall-Mount Hearing Loop Amplifier, 4.75 Amp PRO7/SD 500m <sup>2</sup> Free-Standing Hearing Loop Amplifier, 7.5 Amp PRO7/SW 500m <sup>2</sup> Wall-Mount Hearing Loop Amplifier, 7.5 Amp PRO11/SD 1000m <sup>2</sup> Free-Standing Hearing Loop Amplifier, 11 Amp PRO11/SW 1000m <sup>2</sup> Wall-Mount, Hearing Loop Amplifier, 11 Amp. PDA/RM3 Optional 19 inch rack mount kit for use with free-standing amplifiers

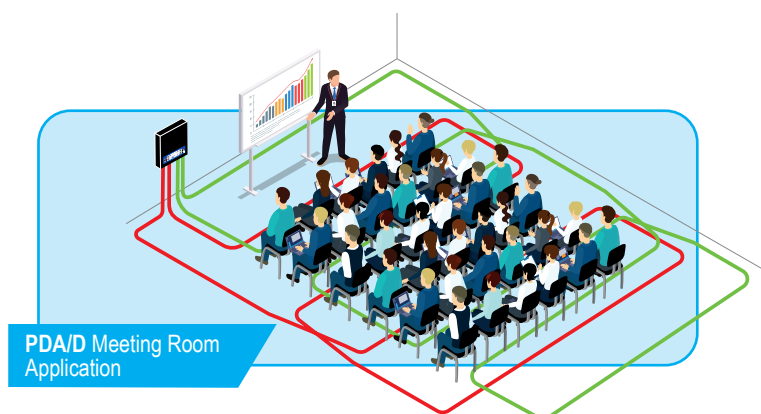
# PDA/D 200m<sup>2</sup>-1000m<sup>2</sup> Phased Array Hearing Loop Amplifiers (LED Interface)

## Key Features

- ▶ A range of high-performance constant current phased array hearing loop amplifiers with Class D output stages for maximum efficiency.
- ▶ Perfect for areas where minimal overspill and consistent coverage (i.e. no dead spots) is essential.
- ▶ Intuitive LED interface allows simple set-up of input levels, output current and metal compensation.
- ▶ 200m<sup>2</sup>, 500m<sup>2</sup> or 1000m<sup>2</sup> coverage (model dependent)
- ▶ 1 x mic and 1 x line input.
- ▶ Outreach connector allows up to 10 of our audio input utility plates to be added - see pages 22/23.
- ▶ Dedicated wall-mount and free-standing options .
- ▶ Lock function prevents unauthorised adjustments.
- ▶ Superior analogue audio processing provides life-like speech and first class music reproduction.
- ▶ Fault relay & intuitive user interface provide clear indication of operation and fault status.
- ▶ Metal compensation control offsets the frequency response problems caused by excessive metal
- ▶ Industry leading dual action automatic gain control compensates for poor microphone technique.
- ▶ Line level output for recording or daisy-chaining multiple units to cover larger areas.
- ▶ Class D output stage for maximum efficiency.
- ▶ Exceeds PD IEC TR 63079 & EN60118-4 when correctly installed & complies with EN62368-1
- ▶ For more on phased array loops see page 26.



CLEAR & INTUITIVE LED INTERFACE



PDA/D Meeting Room Application

## At-a-glance specifications

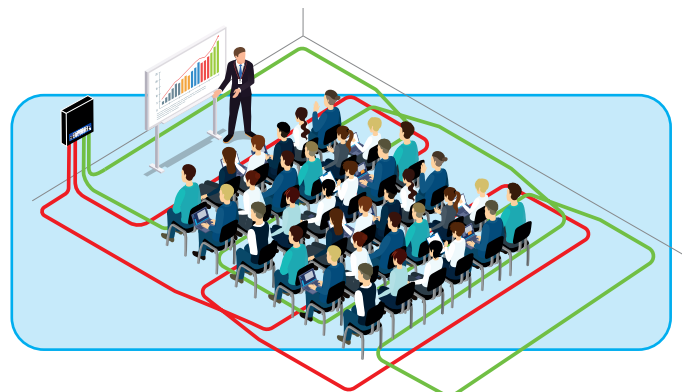
<b>TYPE</b>	Multi-loop (A4). Free standing (PDA5/DD, PDA7/DD, PDA11/DD) or wall-mounting (PDA5/DW, PDA7/DW, PDA11/DW)
<b>COVERAGE</b>	200m <sup>2</sup> (PDA5/DD, PDA5/DW), 500m <sup>2</sup> (PDA7/DD, PDA7/DW), 1000m <sup>2</sup> (PDA11/DD, PDA11/DW)
<b>DIMENSIONS &amp; WEIGHT</b>	W 218 x H 67 D 280mm (PDA5/DD, PDA7/DD, PDA11/DD); W 308 x H 298 x D 74mm (PDA5/DW, PDA7/DW, PDA11/DW)
<b>CONSTRUCTION &amp; FINISH</b>	Mild steel zintec, 1mm thick, black powder coated, IP40
<b>INPUTS</b>	1 x mic with switchable 12V phantom power, 1 x line and 1 x Outreach connector
<b>INDICATORS</b>	Level, peak & limit indicators, Mic, 12V, Line, Metal, Outreach, Lock, Loop 1&2, Phase, Fault 1&2, Hot & Power
<b>CONTROLS</b>	Line Input, Microphone, 12V Phantom, Outreach, Metal Comp, Loop Drive 1, Loop Drive 2, Phaseshift.
<b>KIT VARIANTS</b>	PDA5/DD 200m <sup>2</sup> Free-Standing Hearing Loop Amplifier, 2 x 3.25 Amp PDA5/DW 200m <sup>2</sup> Wall-Mount Hearing Loop Amplifier, 2 x 3.25 Amp PDA7/DD 500m <sup>2</sup> Free-Standing Hearing Loop Amplifier, 2 x 5 Amp PDA7/DW 500m <sup>2</sup> Wall-Mount Hearing Loop Amplifier, 2 x 5 Amp PDA11/DD 1000m <sup>2</sup> Free-Standing Hearing Loop Amplifier, 2 x 7.5A Amp PDA11/DW 1000m <sup>2</sup> Wall-Mount, Hearing Loop Amplifier, 2 x 7.5A Amp. PDA/RM3 Optional 19 inch rack mount kit for use with free-standing amplifiers

### Key Features

- ▶ A range of high-performing constant current, phase-shifting hearing loop amplifiers, with Class D output stages for maximum efficiency.
- ▶ Perfect for areas where minimal overspill and consistent coverage (i.e. no dead spots) is essential.
- ▶ Intuitive graphical interface allows simple set-up of input levels, output current and metal compensation
- ▶ 200m<sup>2</sup>, 500m<sup>2</sup> or 1000m<sup>2</sup> coverage (model dependent)
- ▶ 1 x mic, 1 x line & 1 x optical TOS link input to facilitate easy connection to TVs, soundbars, etc
- ▶ Outreach connector allows up to 10 of our audio input utility plates to be added - see pages 22/23.
- ▶ Dedicated wall-mount and free-standing options
- ▶ Lock function prevents unauthorised adjustments
- ▶ Superior analogue audio processing provides life-like speech and first class music reproduction
- ▶ Fault relay & intuitive surface provide clear indication of operation and fault status
- ▶ Metal compensation control offsets the frequency response problems caused by excessive metal
- ▶ Industry leading dual action automatic gain control
- ▶ Line level output for recording or daisy-chaining multiple units to cover larger areas
- ▶ Class D output stage for maximum efficiency.
- ▶ Exceeds PD IEC TR 63079 & EN60118-4 when correctly installed & complies with EN62368-1
- ▶ For more details on phased array loops see page 26



HIGH CONTRAST EASY-TO-USE GRAPHICAL DISPLAY

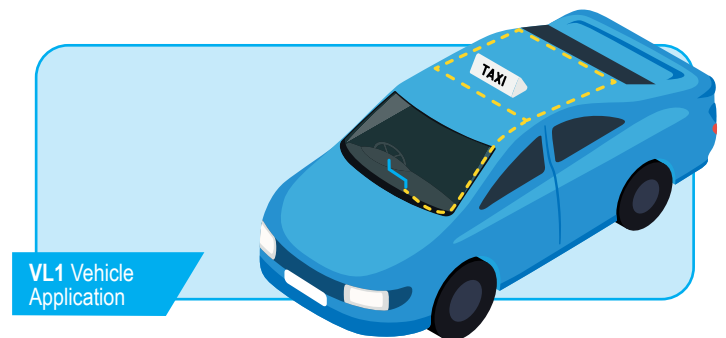


### At-a-glance specifications

<b>TYPE</b>	Multi-loop (A4). Free standing (PRO/DD, PRO7/DD, PRO11/DD) or wall-mounting (PRO5/DW, PRO7/DW, PRO11/DW)
<b>COVERAGE</b>	200m <sup>2</sup> (PRO5/DD, PRO5/DW), 500m <sup>2</sup> (PRO7/DD, PRO7/DW), 1000m <sup>2</sup> (PRO11/DD, PRO11/DW)
<b>DIMENSIONS &amp; WEIGHT</b>	W 218 x H 67 D 280mm (PRO5/DD, PRO7/DD, PRO11/DD); W 308 x H 298 x D 74mm (PRO5/DW, PRO7/DW, PRO11/DW)
<b>CONSTRUCTION &amp; FINISH</b>	Mild steel zintec, 1mm thick, black powder coated, IP40
<b>INPUTS</b>	1 x mic with switchable 12V phantom power, 1 x line, 1 x Outreach and 1 x Optical TOS Link connector
<b>INDICATORS</b>	Level, peak & limit indicators, Mic, 12V, Line, Metal, Outreach, Lock, Loop 1&2, Phase, Fault 1&2, Hot & Power
<b>CONTROLS</b>	Line Input, Microphone, 12V Phantom, Outreach, Metal Comp, Loop Drive 1, Loop Drive 2, Phaseshift.
<b>KIT VARIANTS</b>	PRO5/DD 200m <sup>2</sup> Free-Standing Hearing Loop Amplifier, 2 x 3.25 Amp PRO5/DW 200m <sup>2</sup> Wall-Mount Hearing Loop Amplifier, 2 x 3.25 Amp PRO7/DD 500m <sup>2</sup> Free-Standing Hearing Loop Amplifier, 2 x 5 Amp PRO7/DW 500m <sup>2</sup> Wall-Mount Hearing Loop Amplifier, 2 x 5 Amp PRO11/DD 1000m <sup>2</sup> Free-Standing Hearing Loop Amplifier, 2 x 7.5A Amp PRO11/DW 1000m <sup>2</sup> Wall-Mount, Hearing Loop Amplifier, 2 x 7.5A Amp. PDA/RM3 Optional 19 inch rack mount kit for use with free-standing amplifiers

### Key Features

- ▶ A compact hearing loop system ideal for use in cars, taxis, buses and other vehicles
- ▶ 12V (VL1/B1) and 24V (VL1/B2) versions available
- ▶ 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 in the vehicle 'absorbing' the magnetic field
- ▶ Optional VL9 lead available for connection to the vehicle's audio system
- ▶ Amplifier measures just 3cm high, 12cm wide and 6cm deep making it ideal for dash mounting.
- ▶ Exceeds the requirements of PD IEC TR 63079 & EN60118-4 when correctly installed



### At-a-glance specifications

<b>TYPE</b>	Specialist Loops (A7). Dash mounting; 12V or 24V dependent on kit purchased.
<b>COVERAGE</b>	1.2m <sup>2</sup> approx.
<b>DIMENSIONS</b>	W 120 x H 31 x D 60mm; 220g.
<b>INPUTS</b>	1 x 3.5mm remote mic. socket; 1 x line
<b>INDICATORS</b>	Input level, loop current, power on
<b>CONTROLS</b>	Mic level; Line level, loop drive, metal compensation
<b>KIT VARIANTS</b>	VL1/B1 12V Kit: VL1 Amplifier; TX2 Pre-formed loop; AMT microphone; AL8 Fused cigarette lighter power adaptor; 'AFILS fitted' sticker VL1/B2 24V Kit: 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.

In many ways a microphone is 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, the room acoustics, microphones and the actual application.

Electret microphones have the highest tolerance of magnetic feedback and are therefore recommended for loop systems (all PDA amplifiers have phantom power so electret microphones with internal batteries are not necessary). Dynamic microphones should not be used as

they contain moving coil magnets which can be affected by the loop's magnetic field.

Best practice is to place the microphone as close as possible to the person speaking. Also, to avoid interference, microphone cables should be kept at least one metre away from loop cable.

A method sometimes suggested to capture speech is a ceiling mounted boundary microphone. This should be used with caution as it often places the microphone too far from the sound source. In addition, ceilings can be noisy locations due to air handling noise, lighting and vibration.

## MICROPHONE APPLICATION / SUGGESTED MODEL GUIDE

### Conference table (centre of tabletop, counter, etc):

AMT tie/desk mic  
AMP\* professional handheld mic

### 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  $\leq 2.5m$   
AMC cardioid mic + APXM plate at distances  $\leq 6m$   
PRO45 at distances  $\leq 12m$

### Desk Microphone with Push To Talk (PTT):

AMD/P (as AMD with PTT)

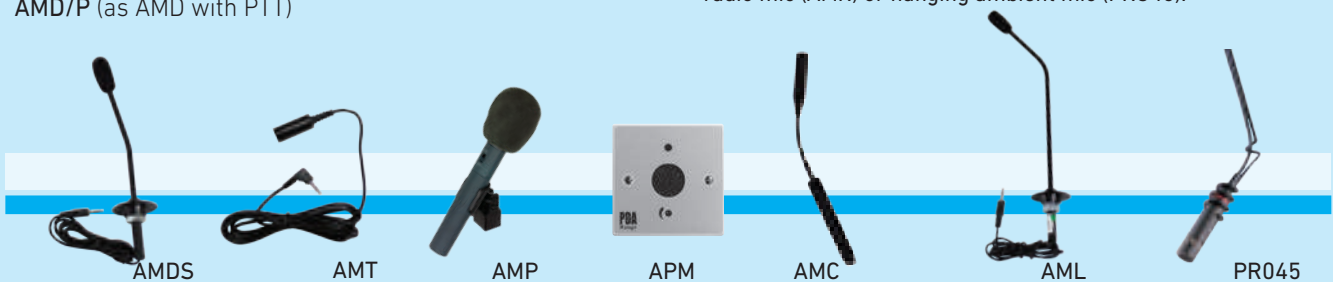
### Ceiling (recessed in the ceiling above a table):

APM at distances of  $\leq 2.5m$   
AMC cardioid mic + APXM plate at distances  $\leq 6m$   
PRO45 at distances  $\leq 12m$

### Handheld:

AMC cardioid mic + APXM plate  
AMP\* professional handheld mic  
AMR/HA (radio mic) - 4 selectable frequencies

\*All microphones except the AMP are supplied with a connection lead. 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  $25m^2$  ( $5m \times 5m$ ). To cover larger areas with this mic, 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, consider using a radio mic (AMR) or hanging ambient mic (PRO45).



## Induction Loop Cable

Many PDA range hearing loop kits include loop cable as standard. For those that don't you can select the cable you require from the list below. Single core cable is ideal for floor or ceiling loops. Copper foil tape is less obtrusive under carpets.

**LOOP1/W** 0.5mm<sup>2</sup> Single Core Induction Loop Cable  
**LOOP2/W** 1mm<sup>2</sup> Single Core Induction Loop Cable  
**LOOP3/W** 1.5mm<sup>2</sup> Single Core Induction Loop Cable  
**LOOP4/W** 2.5mm<sup>2</sup> Single Core Induction Loop Cable

**FLAT1005** 0.5mm<sup>2</sup> Insulated Flat Copper Foil Tape  
**FLAT2005** 1mm<sup>2</sup> Insulated Flat Copper Foil Tape  
**FLAT3005** 1.5mm<sup>2</sup> Insulated Flat Copper Foil Tape  
**TAPE/P** 50m Printed "LOOP CABLE" foil tape



# Outreach Plate

## Audio Input Extension System

Our patented 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 a hearing 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.

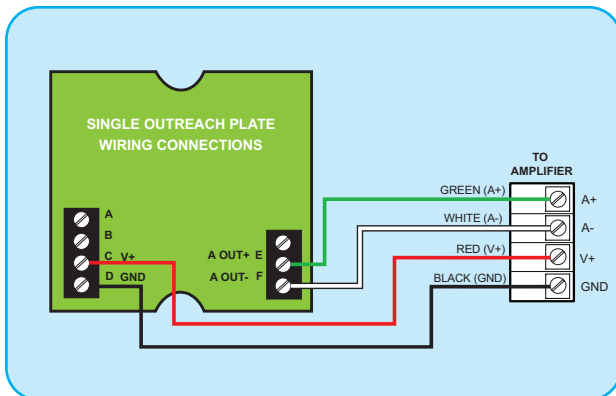
Mountable on 25mm back boxes, each plate features a built-in mixer, pre-amp, input level control and balanced output. The fact they can be installed at the most convenient point on an installation overcomes the need for long and potentially hazardous microphone/audio leads.

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

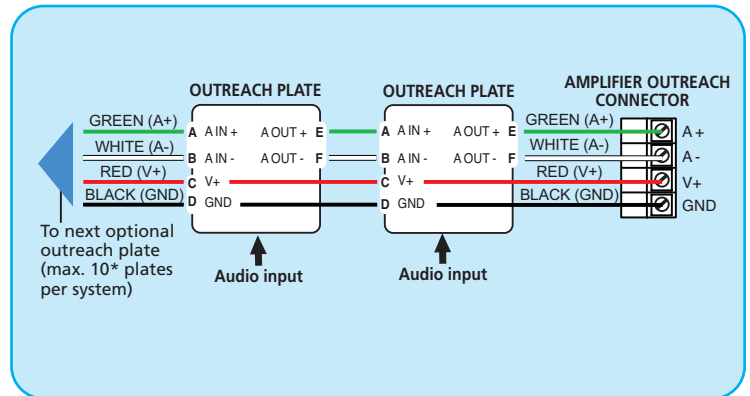


audio cable (such as Belden 8723) with no recognisable degradation of audio signal quality.

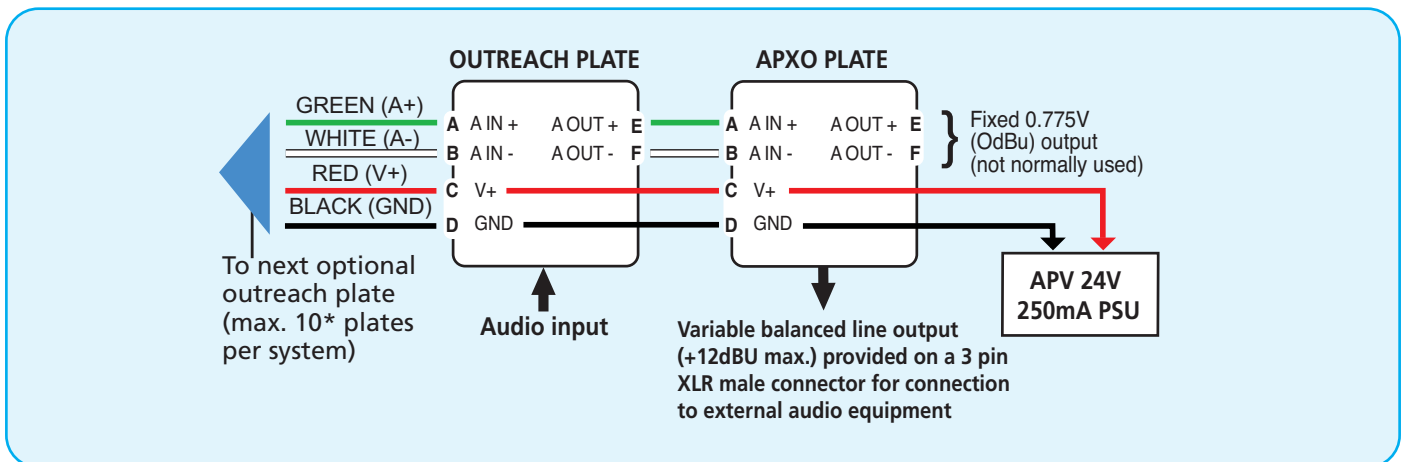
Each outreach plate requires four wires, two balanced line (A +, A -), one ground (0V) and one power connection (12-32 V DC regulated).



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



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



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

# Outreach Plate

## Audio Input Extension System



### APM OMNI-DIRECTIONAL PLATED MICROPHONE

A self-contained omni-directional electret microphone complete with onboard mic to line level converter. Typical coverage up to 25m<sup>2</sup> (ambient) or 2.5m (direct speech) when located at a ceiling height of 2.5-3m.



### 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 12V phantom power.



### 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.



### APXL XLR 3 PIN LINE LEVEL PLATE

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



### 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 12V phantom power.



### APXM/M DUAL INPUT MICROPHONE & DUAL PHONO MIXER PLATE

Accepts balanced or unbalanced microphones with standard 3 pin XLR connectors and dual phono line level input.



### 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 12V phantom power.



### 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.



### 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.



### 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.

# Hearing loop design & Installation

**Hearing loop system design and installation can be simple provided a few basic facts are understood, as detailed below.**

## Maximum area coverage

The approximate coverage provided by an AFILS amplifier is usually quoted in metres squared (m<sup>2</sup>). For example, the 200m<sup>2</sup> 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<sup>2</sup> ticket counter to a large 1000m<sup>2</sup> 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 26 & 27) and/or amplifiers with metal compensation controls. 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 26).

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

Hearing 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 a larger gauge twisted to reduce magnetic losses.

## Loop cable

There is nothing electrically special about hearing loop cable and we can supply two types: 100m reels of single core loop cable (1mm<sup>2</sup>, 1.5mm<sup>2</sup> and 2.5mm<sup>2</sup>) and 100m reels of flat copper foil tape (1mm<sup>2</sup> and 2.5mm<sup>2</sup>). 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 hearing loop calculator as detailed on page 8.

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 a compound, we recommend you check compatibility by covering a small piece of the tape with the compound and look for adverse reactions. If there is an adverse reaction, remove the plastic sheaf from the copper foil tape and run another trial as this can sometimes overcome the issue.

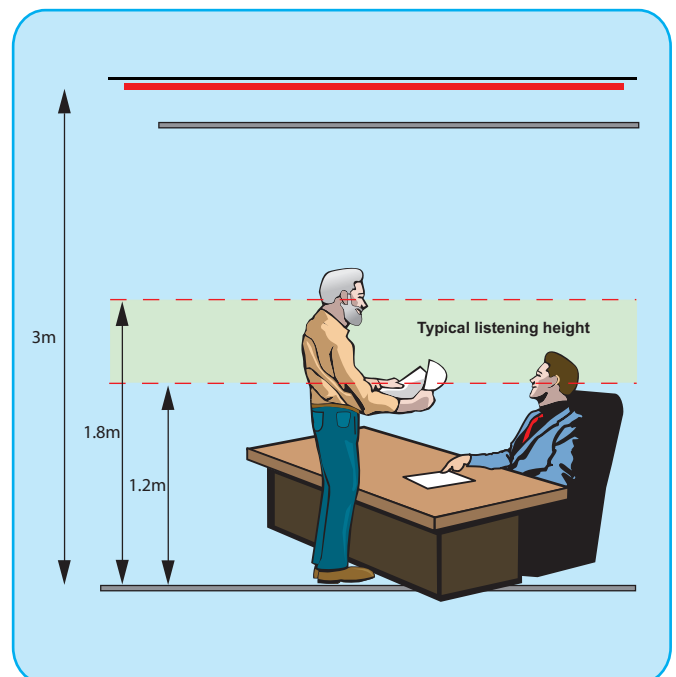
## Loop cable position

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

In low metal content installations, loop cable is usually run around the perimeter of the room ideally on the floor.

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 below the listener at floor height or ceiling height if this is not possible. 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 2m to it as the loop signal will be uncomfortably strong for them.





# Hearing loop design & Installation

## Ceiling loops

Try to locate ceiling loops around 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, around 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 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, try to keep the loop about a metre from large uprights.

## Suspended ceilings

If an application has a suspended ceiling with a metal grid, place the loop cable in suspended plastic conduit in the ceiling void. 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 current on the amplifier. If single core cable fails to provide the required field strength, consider using multi core cable (of appropriate gauge) and 'choc block' to create two loops in series. Although this technique increases field strength it reduces the top-end audio frequencies making the loop sound bass heavy but this can be redressed using the metal compensation control on many of our amplifiers. Alternatively, consider using an infrared system (see pages 30 & 31) as this will give excellent results and require much less installation effort.

## 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 shift loop 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 to ensure the signal is distributed evenly throughout the building. Remember, 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 suggest allowing 20% less area coverage than the amplifier's 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 26.

## Trial loops

Always run a trial loop and evaluate performance by listening to the signal with either a hearing aid or a loop listening device. To ensure the system complies with PD IEC TR 63079 we recommend you test the system following the procedure outlined on page 28.

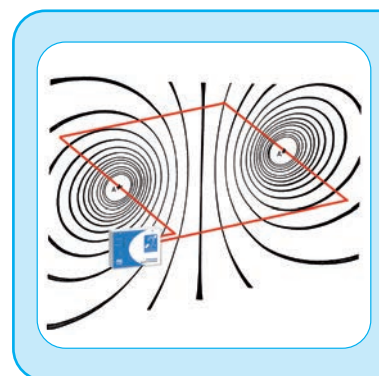
## Dead spots

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 hearing 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.

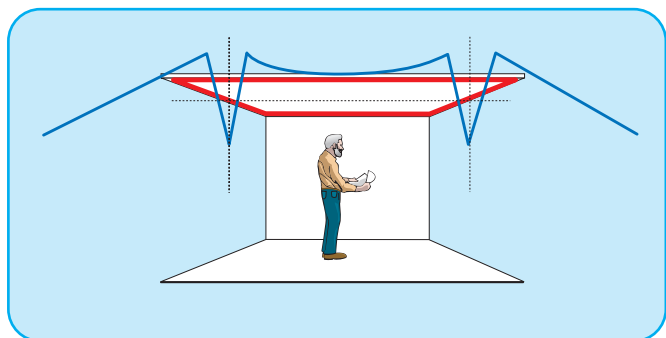


# Hearing loop design & Installation

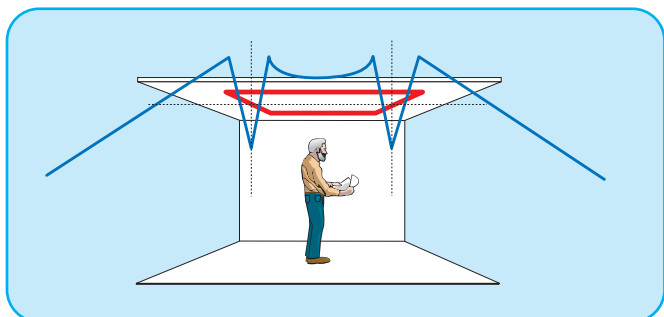
The importance of overspill depends on the application. For instance, it probably won't matter if a church service can be picked up in the church grounds. However, should the signal from one loop system interfere with another in a multi-screen cinema, or a confidential loop signal in a police station be picked up in a neighbouring room, this is more concerning. PD IEC TR 63079 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 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 3m x 5m perimeter loop you can see the signal overspills outside the room before dropping off to an inaudible level at around 10 metres.



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

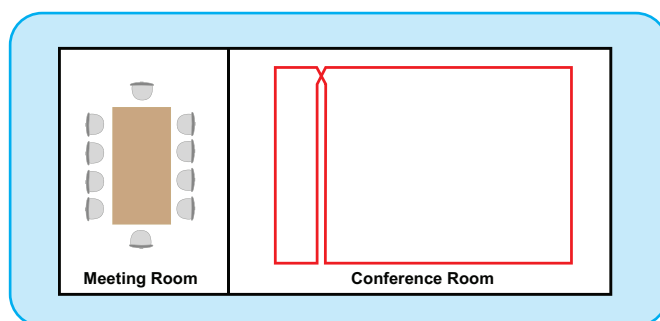


It is important to remember there will be a dead spot immediately above or below the loop cable and that anyone sitting over it won't hear anything. This is due to the fact that hearing aid coils only respond to the vertical component of the magnetic field.

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 is accepted as a 'reasonable provision' as long as people are made aware of this.

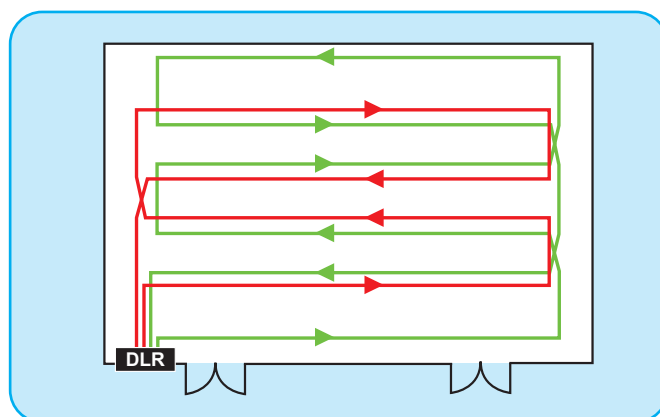
## Reducing overspill in one direction

For applications where overspill needs only to be reduced in one direction a 'cancellation' loop can be used as per the drawing below. 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-array loops

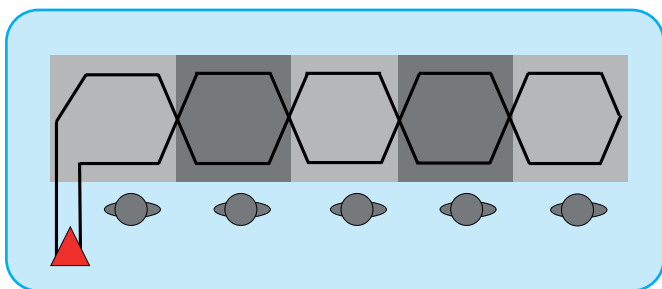
For applications where minimal overspill and consistent coverage (i.e. no dead spots) is essential, consider using one of our phase array dual hearing loop amplifiers (pages 18-19). Although more costly than the reduced sized loops described earlier it will avoid any dead spots being formed inside the 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 hearing loops laid out in a special overlapping pattern (below). The resultant magnetic field is evenly spread within the covered area and the field strength falls off very quickly outside the loop.



# Hearing loop design & Installation

## '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 take separate routes, resulting in an Earth loop. However, most hearing aids are designed to reject such low frequencies, and so this is not normally a practical problem.

## Interference

Hearing 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 before installation. A loop should not cover the stage area.

## 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, say by someone drilling through it and touching a reinforcing grid, the amplifier's output stage will be damaged.

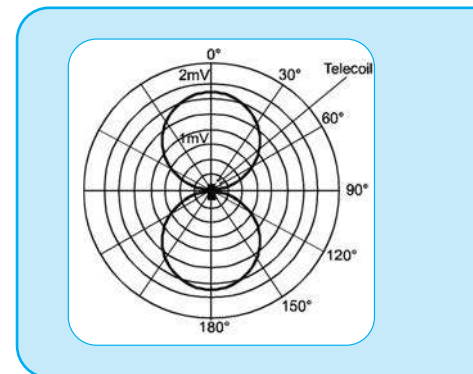
## The isolation issue

When a hearing aid user switches their hearing aid to the 'T' position (if available), 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...

**Before designing a loop system, try to find answers to the following questions. Once done, the information in this guide will then help you provide an effective solution.**

- ▶ What is the area used for (reception, classroom, theatre, etc)?
- ▶ Is a perimeter loop or phased array loop required (e.g. in an area over 5m wide)
- ▶ Do you require an audio input from a TV/Video?
- ▶ Do you require an input from a PA system?
- ▶ Do you require fixed or mobile microphones?
- ▶ Do any rooms close to the area require a separate system?
- ▶ What are the dimensions of the area (length/width/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?

# Testing a hearing loop system

We recommend all hearing loop systems are tested to the latest version of BS EN 60118-4 (Magnetic field strength in audio- frequency hearing loops for hearing aid purposes) using our FPROK1 'Fosmeter Pro' Hearing Loop Test Kit.

The kit includes an FPRO Fosmeter Pro hearing loop tester complete with intuitive display and simple to follow test menus, a calibrated FPROSG Signal Generator complete with pre-loaded test tones and a set of headphones.

As well as checking the magnetic field strength of a loop system, it also measures background noise, frequency response, metal compensation and allows you to listen to the loop signal.

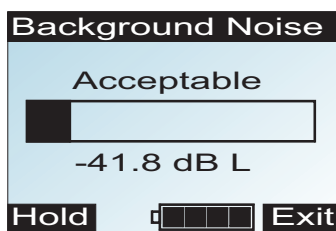
The tester is powered from a 9V PP3 battery and is supplied in a protective canvas carrying case.

## The test procedure

Connect the FPROSG signal generator to the loop amplifier via an appropriate connection lead. Next, set the signal generator to deliver one of three tones into the hearing loop (the tone required is dependent on the test being carried out). Finally, carry out the appropriate tests as detailed below using the Fosmeter Pro tester and log the results on the certificate provided.

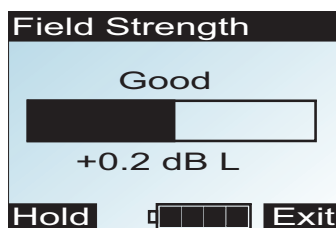
## Background noise test

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).

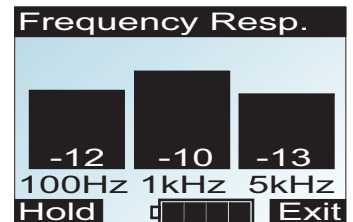


## Frequency response test

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.

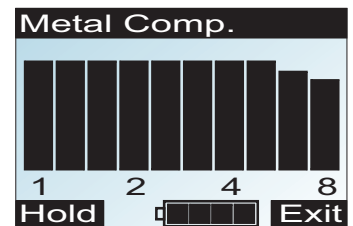
Acceptable results are +/- 3dB L from the

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

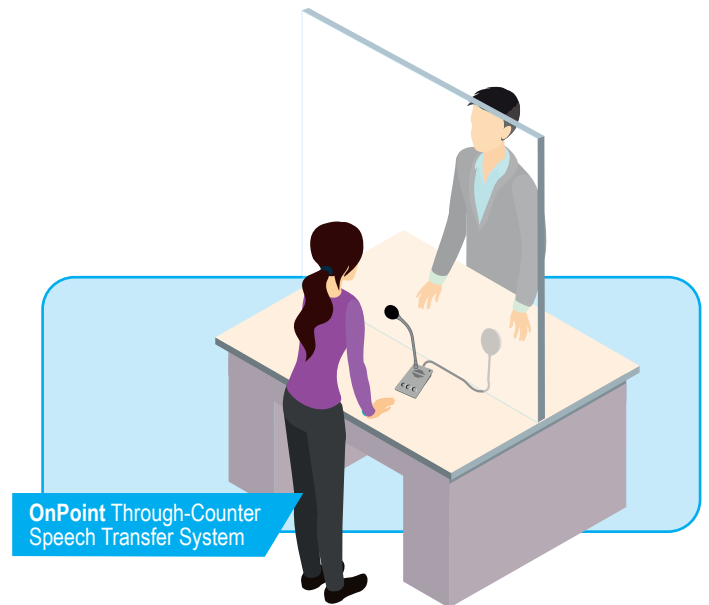
Designed to ensure hearing aid users receive an undistorted and clear signal in the covered area from the system's actual inputs. Requires a set of HEAD1 headphones plugged into the Fosmeter Pro's headphone socket (ideally a hearing aid user should also test the signal using his or her own hearing aid but this is not always possible).



# OnPoint Through-Counter Speech Transfer System

## Key Features

- ▶ A powerful bidirectional "through-counter" window intercom system that helps make ticket counters, reception desks and other areas with a perspex or glazed screen more accessible.
- ▶ Allows social distancing to be maintained by making conversations easier for all people, including those wearing masks.
- ▶ Offers "full duplex" sound quality.
- ▶ Can be easily paired to a PDA103C or ML1 hearing loop amplifier allowing the audio signal to be broadcast directly to a compatible hearing aid.
- ▶ Three different 'scene' settings (noisy/standard/quiet)
- ▶ Analog output allows conversations to be optionally recorded (additional equipment required)
- ▶ DSP (Digital Signal Processing)



## At-a-glance specifications

<b>TYPE</b>	A through-counter audio communication system
<b>POWER REQUIREMENTS</b>	12V/1.5A (via plug and power interface supplied)
<b>INDICATORS</b>	Network status, intercom on, voice broadcast on, recording on
<b>CONTROLS</b>	Voice broadcast, intercom and recording buttons (recording requires additional equipment)
<b>DIMENSIONS</b>	160 L x 95 W x 40 H mm (operator's interface base), 300mm H x 10 W mm (gooseneck mic), 90mm diameter x 30mm H (end user speaker)
<b>CONSTRUCTION &amp; FINISH</b>	Silver coloured metallic finish
<b>OPERATING CONDITIONS/TEMPERATURE</b>	-20°C to +65°C. Max. relative humidity 90% non-condensing

# ListenIR

## Infrared Listening Systems

**Designed to complement our extensive range of audio frequency hearing loop systems, ListenIR is ideal for areas where strict privacy and zero overspill is essential such as courtrooms, classrooms and boardrooms.**

The range includes lightweight IR transmitters and radiators, receivers and accessories, all designed to offer an exceptional end-to-end assistive listening experience. Key system components include:-

- ▶ The LT-84 ListenIR Infrared Transmitter - ideal for use in mid-size spaces such as courtrooms and boardrooms, the LT-84 has multiple frequency options and offers gapless line of sight coverage of up to 2,787m<sup>2</sup> dependent on the number of LA-141 expansion radiators used (max 4 x LA-141 expansion radiators per LT-84).
- ▶ The LR-4200-IR ListenIR Infrared Receiver - a rechargeable IR receiver with connections for an LA-430 neck loop c/w DSP loop drive and an OLED display showing battery status, volume level & more. Charging options include the LA-381-02 12-Way 'Drop-in' Charging Tray and the LA-432-02 4 Port USB Charger.
- ▶ The LA-430 Neck Loop - a high quality neck loop c/w with DSP loop driver for use with the LR-4200-IR infrared receiver. Allows people wearing a telecoil-equipped hearing aid to listen to the signal for a clear and reliable listening experience.

For more information on these products see below:-



### LT-84 ListenIR Infrared Transmitter

- ▶ An affordable, effective and expandable IR transmitter supplied with a 12V DC power supply, mounting hardware & signage.
- ▶ Multiple frequency options simplifies installation and setup.
- ▶ Offers gapless line of sight coverage of up to 2,787m<sup>2</sup> (dependent on the number of LA-141 expansion radiators used).
- ▶ One-cable design utilises a single CAT-5e cable to carry both power and signal to LA-141 expansion radiators.
- ▶ Max four LA-141 expansion radiators per LT-84.



### At-a-glance specifications

<b>TYPE</b>	Can be mounted on a wall, ceiling, or table with the provided hardware.
<b>COVERAGE</b>	2,787 m <sup>2</sup> single channel with LR-4200-IR/LR-5200-IR receivers or 697 m <sup>2</sup> (7,500 ft <sup>2</sup> ) single channel with LR-42/LR-44 receivers
<b>DIMENSIONS &amp; WEIGHT</b>	W 272 x H 32 x D 104mm / 0.4kg
<b>INPUTS</b>	2 x 3.5 mm Mic. inputs; 2 x Dual RCA Phono unbalanced Stereo/Mono line inputs; 2 x Phoenix type balanced line inputs.
<b>EXPANSION CONNECTIONS</b>	2 x RJ-45 providing RF Signal & Power, CAT-5e cable 24 AWG, 100ft. max. cable length; 2 x LA-141s per output connector
<b>INDICATORS</b>	Power; Audio level and IR transmission.
<b>CONTROLS</b>	Power Off/On; 2 x input level rotary potentiometers, 2 x four position frequency selection (2.3, 2.8, 3.3 or 3.8 MHz).
<b>CONTENTS</b>	1 x LA-210 12V DC power supply, LA-344 mounting hardware, 2 x Phoenix type connectors, instructions and 1 signage.

## LR-4200-IR ListenIR Infrared Receiver

- ▶ A compact single-channel IR receiver offering best-in-class sensitivity and range.
- ▶ Has connections for an LA-430 neck loop c/w DSP loop driver for use with hearing aids.
- ▶ Smallest device of its kind - easy to wear and use and for venues to manage
- ▶ OLED display shows channel, battery status, channel status, volume level and more.
- ▶ Lanyard and belt clip options
- ▶ Advanced rechargeable battery technology eliminates the costs and hassles associated with frequent battery replacement.
- ▶ Charging options include the LA-423-02 4-Port USB Charger and the LA-381-02 12-way 'drop-in' Charging Tray.



### At-a-glance specifications

<b>TYPE</b>	Can be worn on a lanyard with a belt clip option
<b>COVERAGE</b>	0.5m <sup>2</sup> via LA-430 neck loop
<b>DIMENSIONS &amp; WEIGHT</b>	W 50 x H 96 x D 17mm / 54g
<b>CONNECTIONS</b>	Two 3.5 mm jack connectors allow users to listen to the IR signal via an LA-430 neck loop or compatible ear/headphones

## LA-430 ListenIR Neck Loop

- ▶ A high quality neck loop c/w with DSP loop driver for use with an LR-4200-IR infrared receiver.
- ▶ Allows people wearing a telecoil-equipped hearing aid to listen to the signal generated from a ListenIR infrared assistive listening system.
- ▶ Flat frequency response and IEC60118-4 compliant field strength generation helps provide a clear and reliable listening experience.
- ▶ Includes an integrated 3.5mm earphone jack.



### At-a-glance specifications

<b>TYPE</b>	Designed to be worn around a user's neck.
<b>COVERAGE</b>	0.5m <sup>2</sup>
<b>DIMENSIONS &amp; WEIGHT</b>	72cm (length of neck loop) / 43g.
<b>CONNECTIONS</b>	Two 3.5 mm jack connectors for connection to an LR-4200-IR Receiver and a separate integrated 3.5mm jack socket.

## LA-401 Universal Ear Speaker

- ▶ Used for testing when a hearing aid is not available.



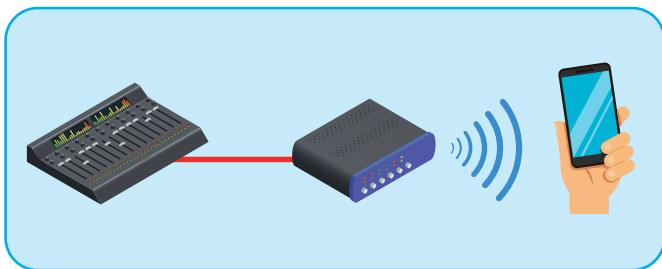
# Listen EVERYWHERE

## WiFi Audio Streaming Solution

Introducing our new Listen EVERYWHERE system - a premier Wi-Fi streaming solution for use in houses of worship, sports bars, restaurants, universities and many other venues.

### Key Features

- ▶ Provides high-quality audio directly to a user's smartphone via a free app.
- ▶ A cost effective way to enable assistive listening, language interpretation and multiple room/channel audio
- ▶ Can use a venue's existing wireless network and accommodate 1,000 users per server.
- ▶ All the user needs to do is download the Free Listen EVERYWHERE App, connect to the venue's wireless network and choose their desired channel



### At-a-glance specifications

<b>LW-100P-02 Server</b>	Designed to be worn around a user's neck Number of Channels: 2 mono, 1 stereo Number of simultaneous users: 1,000 Latency: iPhone – 40ms-120ms Android – 40ms-120ms Audio Connector: Terminal Block/RCA Power Supply: 5 VDC, 4A
<b>LW-200P Servers</b>	Models Available: LW-200P-04, LW-200P-08, LW-200P-12, LW-200P-16 Number of Channels: Mono: 4, 8, 12, 16 Stereo: 2, 4, 6, 8 Number of simultaneous users: 1,000 Latency: iPhone – 40ms-120ms Android – 40ms-120ms Audio Connector : Terminal Block Power Supply : 5 VDC, 4A



**Alert Buddy is designed to inform the deaf or hard of hearing of a fire alarm situation in a domestic or commercial setting.**

## Key Features

- ▶ Can be wall mounted or will sit on top of a table.
- ▶ Combined Silence / Test button
- ▶ Includes Smart listening technology to detect the presence of a Fire Alarm signal.
- ▶ Visual Alarm Indicator to EN54-23 (0 Class)
- ▶ Connection for a BF320 vibrating pillow pad.
- ▶ Low frequency (<1KHz) tone sounder 75dBA @ 1m.
- ▶ Compatible with C-TEC's ActiV range of fire detectors and sounder/VADs.
- ▶ Monitored detector circuit to support up to 4 devices.
- ▶ Additional sounder circuit supporting a 50mA output.
- ▶ Optional radio interface to connect to a CAST or HUSH PRO I/O unit, to receive system wide activation status.
- ▶ Built in strain relief for all external connection wires
- ▶ Plugtop charger/adaptor supplied



Works by monitoring and listening to the ambient sound in a room and automatically detecting the presence of a fire alarm signal. When a fire signal is detected, Alert Buddy will flash, emit a low frequency tone and activate a vibrating pillow pad (available separately). This combination of light + sound + vibration helps maximise the chances of someone being alerted to a fire alarm even if they are sleeping.

## At-a-glance specifications

<b>Dimensions:</b>	206 (L) x 108 (W) x 61 (H) mm
<b>Operating Voltage:</b>	20V
<b>Quiescent Current @ 18 V:</b>	2mA
<b>Quiescent Power Mains:</b>	40mW via plug top charger/adaptor
<b>Plugtop Charger:</b>	UK, with 2.5mm diameter Barrel connector. 20V d.c. 0.9A +/-5% to EN62368-1
<b>Vibrating Pillow Pad monitoring:</b>	Short & open circuit monitored via 6k8 EOL fitted in pillow pad.
<b>Detector circuit monitoring:</b>	Short & open circuit monitored via EOL Cap
<b>Sounder circuit monitoring:</b>	Short & open circuit monitored via 6k8 EOL
<b>Peak SPL at Vmax:</b>	75dBA at 1m
<b>Sounder circuit:</b>	50mA @ 18V
<b>Detection circuit:</b>	Up to 4 ActiV detectors
<b>Controls:</b>	Test button/combined with Silence
<b>IP Rating (EN 60529):</b>	IP21
<b>Operating Temperature: -</b>	5 to +40°C. Max relative humidity 95%
<b>Standby:</b>	Li-Ion 3.7v 10 year rechargeable battery 72hr standby time + 5 min alarm per BS 5446-3

### Want to know more about assistive listening systems?

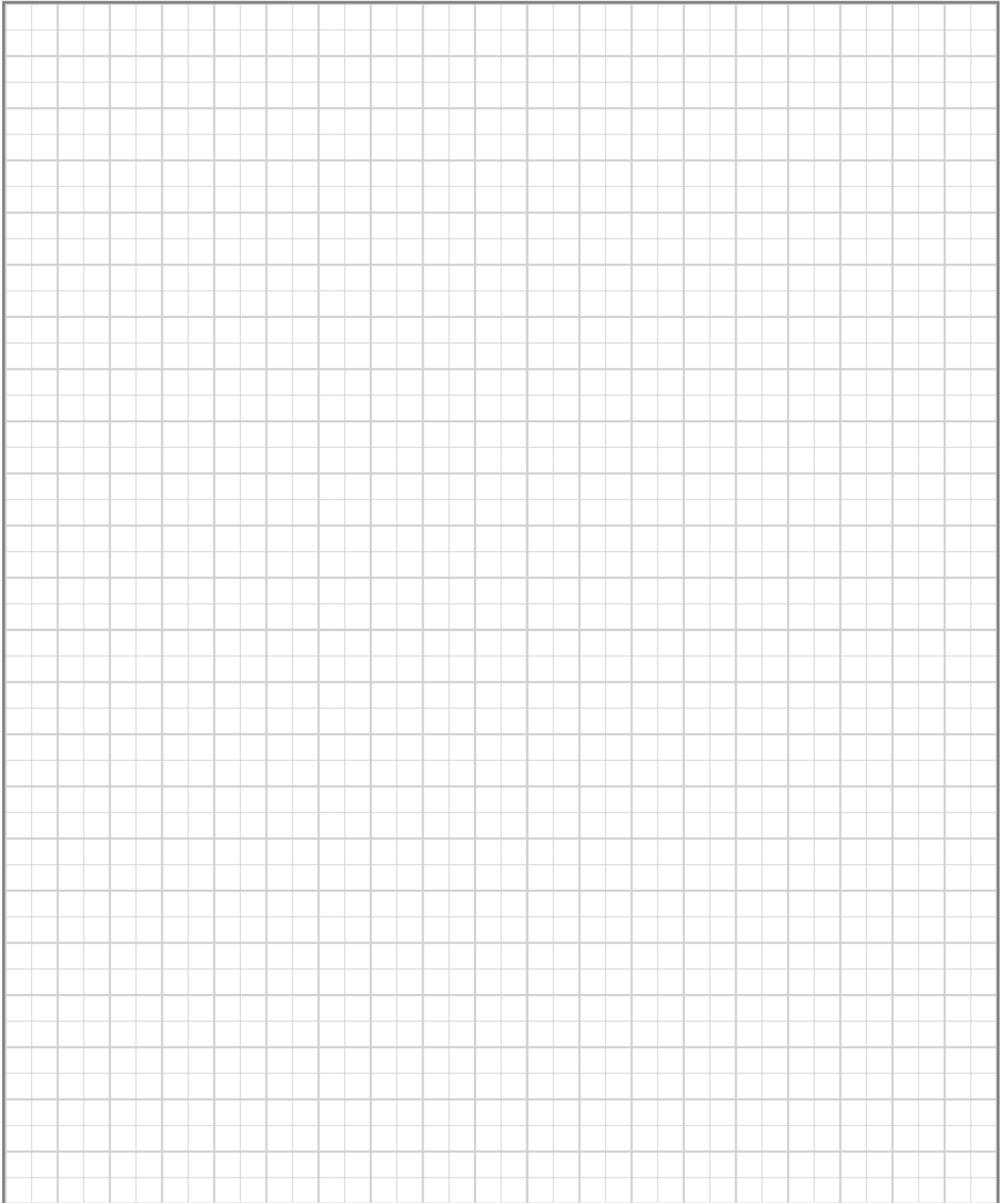
Why not attend our **free** 'Hearing Assistance Solutions: The Route to Equality Act compliance' training course now available at our premises or online?

#### Topics covered include:

- ▶ What is a disability?
- ▶ How many people are hard of hearing?
- ▶ The Equality Act and what it recommends for the hearing impaired
- ▶ Other relevant legislation and schemes
- ▶ An overview of the auxiliary aids available, including infrared, radio, sound field, through-counter speech systems and hearing loop systems – how they work, pros and cons and typical applications
- ▶ A full run through of all of the amplifiers in our range and how to specify them
- ▶ Microphones: How they work and which ones work best in the built environment
- ▶ Audio inputs: Outreach plates and the difference between Line and Mic inputs
- ▶ Phased array loop technology: what it is and how to design, install and test them to EN60114-8 / BS7594

**Ideal for beginners or experts alike, lasts 2-3 hours (first hour is CPD certified).**

**Please contact our sales desk for details.**





**Getting the message across**

**signet-ac.com**

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T: 0844 800 1625 F: 0844 800 4600 E: [info@signet-ac.co.uk](mailto:info@signet-ac.co.uk)

**Available from**

