

LOOP SYSTEMS

A COMPILATION OF ARTICLES PUBLISHED BY FERROSOUND



SOUND INNOVATIONS FOR HEARING IMPAIRED PEOPLE

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AN INTRODUCTION TO LOOP SYSTEMS

The Hearing Loop System is a special type of sound system which may stand alone or as part of an integrated sound system. Sound systems for use in public places are generally used to reinforce or relay sound to a hall, church or auditorium or to other parts of the building from some central point. The loop system transmits the sound directly to people's hearing aids.

Sound reinforcement is the term used to describe a system where the audience can hear the original sound (say, from stage or rostrum) both directly and via the sound amplification system.

Public address system is the term used to describe a sound system used to relay sound to areas of a building where the original performer, speaker or musician, cannot be heard without the use of the sound system. This may be used, for example, in a large sports arena or to relay speech or music to different parts of a building where the sound source is out of earshot.

The most basic sound system comprises four main elements: at least one microphone, one sound amplifier, at least one loudspeaker and an equipment rack or console to house the equipment.

The Hearing Loop System is a special type of sound system for use by people with hearing aids, in which the loudspeaker is replaced by the induction loop. This transmits the sound to the hearing aid (switched to 'T'). It is, in effect, a wireless transmission system in which the hearing aid becomes a mini-receiver, when switched to "T". Because it operates at audio frequencies, the hearing loop system is generally known as an Audio Frequency Induction Loop System or **AFILS**.

Ferrosound offer an AFILS design-to-commission service with full training & technical support. Though simple in principle, AFILS require careful and sometimes complex design by an engineer experienced in the field. This is especially so in medical environments where special chairs and beds are often used for examinations and treatments. With over 20 years experience in the field, our systems are well conceived, well-engineered and user-friendly products. All systems include a **tutorial** with full instructions, and telephone **technical support**.

The AFILS Code of Practice BS 7594 sets the standards which hearing impaired people need and are entitled to expect. This Code covers all aspects of design, operation and customer service, for AFILS in public places. We will not knowingly breach this code, nor lower our design and engineering standards, in order to cut costs or compete with other AFILS suppliers.



AUDIO FREQUENCY INDUCTION LOOP SYSTEMS (AFILS)

SOUND INNOVATIONS FOR HEARING IMPAIRED PEOPLE

AFILS CODE OF PRACTICE: BS 7594 (1993)

The AFILS Code of Practice is an extensive technical document (over 80 pages) covering all aspects the design, operation and customer service, relating to AFILS in public places. The Code of Practice is also followed in so far as it may be applied to our range of portable loop systems.

Ferrosound do not accept commissions that require us to depart from the AFILS Code of Practice, or to install inferior quality equipment, or to lower our engineering standards in any way, in order to cut costs. However, we will use selected low cost equipment of proven reliability and quality, where customers are on a limited budget.

Departures from the Code of Practice may sometimes be necessary for good reasons anticipated within the Code, which we will discuss and agree with our Clients.

THE AFILS SURVEY

Where a hearing loop system is to be used, it is important to make a thorough survey.

The purpose of the survey is twofold. Our engineer will consult with the customer, to gain a full picture of how the loop will be used, and then assess the suitability of the venue for the operation of an AFILS. As such, it is an essential prerequisite for good design, especially for a first-time loop installation in any venue.

To this end, the survey includes the following essential elements:

- 1 **Measure loop area** dimensions in order to calculate theoretical loop current.
- 2 **Measure electromagnetic interference (EMI)** within loop area from all possible sources, especially lighting circuits, to assess viability of AFILS.

It is not uncommon for EMI to be so bad, often due to mains lighting loops, that a loop system simply cannot be used. Sometimes it may be possible to reroute electrical wiring to remove the mains cable loop. Failing this, we can supply wire-less infrared or radio systems, for which each user will require a receiver unit and phones. This is far from ideal for someone who needs to use a hearing aid.

- 3 **Assess metal loss effects:** install test loop, and complete basic loss and frequency response tests. Determine metal loss correction.

It is often necessary to specify a loop amplifier with a higher current rating than the theoretical design requires. This will compensate for losses due to the metal content of the building, such as steel frames, suspended ceiling grids and steel reinforced concrete floors.

- 4 **Evaluate other factors** that may have a bearing on the design of an AFILS or, in the worst case, preclude its use altogether. Such factors include: unusual loop shape, ambient noise from traffic or air conditioning, a requirement to loop more than one room, and the close proximity of loop systems in neighbouring venues. Please see general note 7 below.

APPOINTMENT OF RESPONSIBLE PERSON

The Code of Practice requires an organisation to appoint someone to be responsible for the care and correct operation of their audio frequency induction loop systems (AFILS). This person need not be technical but should have a good working knowledge of how to operate (where applicable) and monitor the system for correct operation.

SYSTEM MANUAL, TRAINING & TECHNICAL SUPPORT

The Code of Practice also requires that the AFILS supplier provides a service schedule, operating instructions and full training for the responsible person and any other people who may be involved with the use of the system. Ferrosound provide this training and long-term technical support as part of their service to all their AFILS customers.

TRIALS

On completion of installation, all Ferrosound systems are subject to proving trials, usually for a period of 30 days. During this period our engineer will provide the **training** session, and **attend two meetings** for the purpose of evaluating the system. The first is informal, when we hope that at least four people with hearing aids can be present, as required by the AFILS Code of Practice. The second may be either informal or a formal 'public' meeting, attended by as many people as possible.

LIMITATIONS OF HEARING LOOP SYSTEMS

It is important to note that most but not all hearing aid users will benefit from the hearing loop. Please note the following limitations:

- **People who cannot hear clearly, even with a hearing aid**, may not benefit from the use of the AFILS.
- **Profoundly deaf people may derive only limited benefit** from a hearing loop, though this will depend on the nature of their hearing loss and the extent to which their hearing aid effectively corrects this loss.
- **Not all hearing aids are fitted with the "T" (telecoil) option.** This applies mainly to canal and other in-the-ear aids. Although most NHS hearing aids are fitted with the "T" option, many commercial aids are not.
- **Some smaller hearing aids have very poor "T" sensitivity.** It is not good practice to increase the loop level of an AFILS in a public place, to meet a particular person's need, since this is set to the level specified by the BS EN 60118-4.
- **AFILS in close proximity may not be used simultaneously.** Please see general note 7 below.

GENERAL NOTES

1. **Loop Area.** In accordance with the AFILS Code of Practice, we recommend that the full seating area of your church, hall, conference room or other venue, be covered by the hearing loop system. This ensures that all people with hearing aids have full and normal access.
2. **T-Logo.** It is also good practice to display the T-Logo to let people know that a hearing loop system is in operation. This is required to show the name and contact number of your supplier and the person responsible for your loop system.
3. **Microphones.** Ferrosound use capacitor microphones, where possible, especially when they will be used within the loop area. This type of microphone is more sensitive and will not interact with the loop. (Please see note 4 below).
4. **Electromagnetic feedback.** Dynamic microphones and some other equipment, including tape recorders and electric guitars, are prone to interference from the loop signal, which may give rise to electromagnetic feedback - a high pitched whistle. For this reason care

must be taken to correctly connect and test any external audio equipment to be used with the System. Ferrosound will be pleased to advise on this matter, during the design consultation & trials period.

5. **Monitoring.** Full performance monitoring is required by the AFILS Code of Practice, including headphone monitoring of actual loop signal. Full details will be supplied with the System Handbook.
6. **Induction receivers** may also be used for monitoring. People who do not use a hearing aid may also use them with headphones.
7. **Multiple loops.** Conventional, perimeter loop systems transmit well beyond the area of the loop albeit at a lower level. Therefore, multiple systems loops in close proximity may not be used simultaneously. This limitation may be overcome by special "low-spill" system designs for which full and detailed drawings will be required showing full dimensions of the building and details of the metal content.
8. **Confidentiality.** Low-spill systems may also be used where confidentiality is required. Although over spill can be limited to a very low level, typically 40 db, below the normal signal level more complex designs are required for secure systems where absolute secrecy is vital.
9. **Electromagnetic interference (EMI).** This may be a problem for people using hearing aids. EMI may be heard as a loud hum in the hearing aid switched to "T", even when the loop system is switched off.

EMI may take many forms, most commonly a hum from installed mains cables. This is often due to mains loops created by switched lighting circuits. It is therefore most important for electricians to avoid creating mains loops, since in the worst case, the radiated interference will make it impossible to use a loop system. PC monitors (except TFT flat screen type) and other electrical apparatus may also seriously interfere with the hearing aid on 'T'

Ferrosound test and record the levels of EMI in all loop locations, as part of the essential Survey and prior to installation.



FERROSOUND INSTALLED SYSTEMS QUALITY STANDARDS

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All *Ferrosound* systems are designed, installed and commissioned to the highest engineering and safety standards, in conformity with the following specifications, where applicable.

BS6259 (1997)

BS7594 (1993)

BS EN 60118-4 (2006)

Building Regulations

European directives and norms

Sound Systems Code of Practice

Code of Practice for hearing loop systems

Magnetic field strength in hearing loop systems

Section relating to hearing loop systems design

EMI Emissions & Immunity

The Low Voltage Directive - safety regulations

INSTALLATION

Care is taken by our designer, electricians and audio technicians to ensure discrete installation of cables and equipment, to blend with the décor and furnishing of the venues in which our systems are to be installed.

High quality cables, accessories and equipment are used throughout. Cables are discretely installed, contained and terminated with appropriate connectors. All mains, high level and new building electrical installation is carried out by one of our ECA or NICEIC registered colleagues. Our multi-skilled audio technician may complete other installation work, including high quality surface wiring. Our *Ferrosound* engineer supervises all installation work.

Induction loop and other audio cables are clipped directly to the fabric of the building where this may be done discretely and without rendering the cables vulnerable or creating a hazard in any way. Where aesthetic or safety considerations preclude this option, or when our customer specifies otherwise, cables may be installed in conduit or mini-trunking. Other options include laying the loop cable in ceiling voids (except where ceilings are suspended), in conduit under (or in) the floor (during construction) or laying a copper foil conductor under a carpet where possible.

All systems are housed in custom-made equipment racks or cabinets, as appropriate, consistent with good engineering and safety standards. Equipment racks are usually black, powder coated steel. Timber cabinets are usually solid pine finished to match décor. Other options and materials are available to order.

GUARANTEE

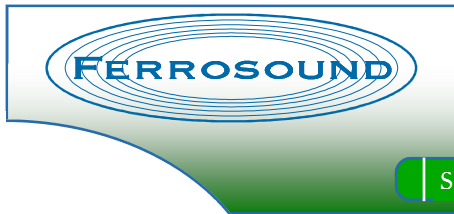
Ferrosound systems are guaranteed for two years, subject to reasonable care but excluding loose cables and accessories, which are covered by the manufacturer's warranty where applicable. Accidental damage, misuse or abuse of the system & accessories are also excluded. This does not affect our Customers' statutory rights.

SERVICE

A service schedule is included with the system manual. In accordance with the AFILS Code of Practice, we recommend a full service every **12 months**, when all equipment and accessories may be checked and loop levels re-set as necessary.

TECHNICAL SUPPORT

Our customers may telephone at any time for long-term technical advice or support.



SELECTING THE RIGHT MICROPHONE FOR THE JOB

SOUND INNOVATIONS FOR HEARING IMPAIRED PEOPLE

It is most important to select the right microphone for the job. This will vary with the application – for example speech, vocal, or instrumental – and type of meeting. Your choice of microphone will also be influenced by the number of people present, the extent to which they will be expected to participate, and the size and acoustic nature of the venue.

BASIC PRINCIPALS

- The further away you are from the microphone, the more your speech will be coloured (distorted) by room acoustics.
- The further away you are from the microphone, the less effective will be the system's control of the loop signal & background noise.
- Hearing impaired people are far less tolerant of this loss of quality and background noise than normally hearing people - who may not even notice either.
- Condenser microphones are very sensitive and do not interact adversely with loop systems.
- Wireless microphones allow free movement & avoid the hazards of trailing cables.

INDIVIDUAL PRESENTATIONS

It is always better to speak within 6-18" of the microphone. It is, therefore, best to use either a clip-on or a hand-held microphone. The latter may be held or fixed to a table or floor stand. To focus more clearly on the speaker, use a unidirectional microphone. This will focus your speech and reduce noise and reflections from around the room.

SEMINARS / GROUP ACTIVITY

One or two well-placed fixed microphones may suffice: for example, a single boundary microphone for a small group of maybe six people at a round table. Or an overhead, hyper-directional (rifle) microphone may be focused on the group from a distance – but the microphone position is critical and more than one microphone may be necessary. How effective this will be depends on room acoustics, the distance of group members from the microphone(s) and how well they speak up.

CONFERENCE / COMMITTEE MEETINGS

Multi-microphone systems are ideal for group use, where practicable and affordable. They require additional equipment to mix the signals from all the microphones. FerroSound have developed a single line, multi-microphone system, which enables members of a group to have their own clip-on microphone, at relatively low cost.

However, it is often more affordable and simple to deploy one or two suitable boundary microphones. FerroSound can custom-make discrete wireless versions for conference tables where trailing cables are not desirable.

RECEPTION, REGISTRATION, CROSS-COUNTER & SIMILAR APPLICATIONS

Microphones need to be carefully chosen and deployed for this type of local loop system. Where possible, FerroSound select and place microphones so as to provide benefit for people on both sides of the counter or reception/registration desk. We have also developed a portable local loop system, which is superior to any similar portable loop system on the market.

UNDERSTANDING WIRELESS MICROPHONES

Wireless microphones are widely used in churches, clubs, entertainment venues, conference and lecture rooms. They also provide a safe, option for use in homes and centres for older people, where trailing microphone leads may be hazardous.

Wireless microphones for use in these applications operate on two frequency bands – **VHF** and **UHF**. UHF wireless microphones largely replace the older VHF although the later are still available. In each band there are a number of frequencies available for public use, for which no licence is required, provided the equipment is type-approved.

Because **wireless microphones** are very widely used in all these venues, there is always the chance of interference between systems. This occurs when venues within range of one another (up to 100 metres) are using the same frequency channel. More expensive systems are multi-channel, so it is a simple matter to select another frequency. The lower cost systems are pre-set to the frequency of your choice, so it is necessary to replace the whole system in order to change the frequency channel.

The more expensive, UHF wireless microphones are generally better quality and less prone to interference, than VHF microphones. The UHF band is also less crowded. Moreover, even budget UHF systems are available with multiple frequencies, so it is a simple operation to switch from one channel to another, when necessary.

A Wireless microphone system comprises an ordinary microphone (any type), a transmitter and a receiver. Each system requires its own radio frequency, or channel, in the same way that broadcast radio & TV does. The **transmitter** may be built into a hand-held microphone, as an integral unit, or into a small case, which may be clipped to a belt or placed in a pocket. In the latter case, a separate **microphone** is plugged into the transmitter. This microphone may be clipped to clothing or built into a headset.

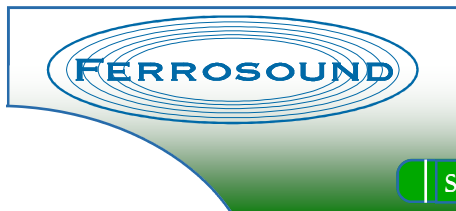
Transmitter packs require a good quality alkaline battery, usually 9v PP3 or 1.5v AA. High capacity rechargeable NiMH batteries may also be used. Battery life may vary from 6-12 hours according to the make and model of the wireless system.

The **wireless receiver** is usually housed in a case, which is free standing or rack-mounted, and requires dc power from a small mains power supply unit. Receivers may also be very compact, battery-powered, pocket-sized units for mobile use.

In this field, there are two types of wireless microphone system, the diversity and the non-diversity type. The **diversity** system employs two aerials and is more reliable in larger venues. It also reduces interference between radio signals when more than one radio microphone is in use. The less sophisticated **non-diversity** receiver costs less and may be fine in smaller venues, or where only one system is in use.

Ferrosound can source and supply any wireless microphone system on the market. This enables us to provide a truly custom service, tailored to our Customer's application and budget. The best guide to price is to spend as much as you can afford!

Budget range microphones supplied will be good quality, reliable products. However, they may not include useful features available on higher priced microphones. For example, it is very useful to have **low battery indicator**, which is generally only available on more sophisticated microphones. It is also useful to have **multi-channel systems**, so channels can easily be switched to avoid interference from other users, should that occur. Multi-channel systems also allow more flexibility in the use of the actual microphone (transmitter). And, of course, it is important to consider **sound quality** – especially with hearing loop systems, where the user requires the best quality possible. The *more sophisticated systems provide more useful features and higher sound quality* – but they cost significantly more.



ACCESSORIES CHECK LIST FOR HEARING LOOP & SOUND SYSTEMS

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MICROPHONES

Wired	Cable connects microphone with system	
Wireless	VHF de-regulated UHF de-regulated VHF/UHF regulated	Wireless licence exempt channels Wireless licence exempt channels Licence required (many more channels)
Type/Application	Hand-held Clip-on style Boundary Conference	For use also with table & floor stands Allows speaker to move about Circular (roundtable) meetings Multiple microphones with mixer
Polar pattern	Omni-directional Uni-directional Rifle	Even pick up of sound all round Focus on sound from one direction Narrow focus from one direction
Stands	Table Floor	Fixed or telescopic, with or without boom Telescopic, with or without boom arm

CABLE REELS Open For loop or other cables – no jamming

AUDIO CABLES

SCART	Various lengths	For use with TV, video
Phono	Various lengths	For use with audio equipment
Custom	Please specify	Equipment and application
Adaptors	Various	Please specify equipment and application

LOOP MONITOR RECEIVER with headphones

'T' LOGO Free-standing in clear plastic stand

TROLLEY For heavy equipment. Folds down to small size for transit

FLIGHT CASES For microphones and other small accessories

HOLDALL For microphone and loudspeaker stands

ACTIVE LOUDSPEAKERS Add sound reinforcement to loop system

CD & TAPE MACHINES May be full integrated within Loop System case(s)

CUSTOM EQUIPMENT & ACCESSORIES - All things are possible!

Ferrosound have developed and custom-build a range of portable hearing loop systems and accessories for use in the community. Each system is built into a portable equipment case, fully pre-wired and ready for use. The systems cover loop areas from 20-500 square metres, depending on loop shape. A wide range of microphones and accessories is available for all applications.

A strong **carry-bag** is also available for microphone stands and accessories. To ease the journey from car park to venue, a lightweight, telescopic **clipper trolley** is available. This folds to a very compact size for transit. Very high quality, **flexible loop wire** is used, which is stored on **jam-free cable reels**. A **"T" logo** is included.

Single or twin case options are available. Twin case models allow **ample space for expansion** - for example, to include more microphones, additional mixing equipment, CD player or an integral sound reinforcement amplifier. Two cases also spreads the weight load.

All systems are custom made following a free **telephone design consultation** without obligation. This enables our engineer to design the optimum system for your requirements and budget.

Our custom-made systems are **clearly labelled** to identify all components, controls, cables and accessories, and to comply with safety regulations. The suffix number indicates the loop area coverage for square/rectangular loops respectively (in square metres).

The smaller systems are built into flight cases (see picture opposite). The larger, very high quality, professional systems are built into lightweight, portable equipment cases (see system illustrated on next page).

A **Tutorial** is provided with all systems, within the **Manual** supplied and supported by a telephone **Helpline**. This takes the non-technical operator set-by-step through the setting up procedure, showing how to install, test and monitor the system, so that it conforms to BS EN60118 part 4 and BS7594, in so far as these are applicable to portable systems. We strongly recommend that all operators complete this Tutorial before attempting to set up and operate the system in a public meeting.



PLS-20/35 Portable Loop System

All systems are fully pre-wired and operationally ready to go. Once the tutorial is completed and the operator is familiar with the equipment, the following procedure will seem very simple:

- Place system on suitable table
- Fit the loop cable around the seating area
- Plug in the required microphone(s)
- Plug into the mains and switch on
- Monitor loop level and sound quality



Portable sound system designed and built for a local authority customer. This illustrates the various component parts available:

Twin Equipment Cases Containing:

- 150W + 150W dual sound amplifier
- Storage space – accessed from rear
- Induction loop amplifier up to 250 sq. metres
- Wireless microphone receiver x 4
- Microphone mixer – 10 channel
- Combination CD and tape recorder with remote control

Accessories on Bench:

- ‘T’ Logo
- Loop cable reel
- Wired microphone on table stand

Accessories on Floor:

- Microphone stand with wireless (hand) microphone
- Clipper trolley (folded for transit)
- Hold-all for stands and cables
- Very flexible loud speaker cable
- Tutorial and operational instructions in folder (not shown)