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Solutions to improve the quality of life



ILD9

INDUCTION LOOP DRIVER

1. INTRODUCTION

The ILD9 Induction Loop Driver has been designed as a very high quality driver for medium size audio frequency induction loops. Ease of installation and use have been major factors in the design, combined with optimised performance, and freedom from R.F.I generation to meet all future technical requirements.

To ensure compliance with all technical standards, it is essential that the equipment shall be installed by an individual who is technically competent in professional audio, and who has the necessary installation skills.

Warranty Information

This product carries a 5 year parts and labour warranty which could be invalidated if these instructions are not followed correctly, or if the unit is tampered with in any way.

The 5 year warranty is dated from the time the equipment leaves Ampetronic and NOT when it is installed.

2. PRELIMINARY INSTALLATION DATA.

- 2.1 Inspect the equipment upon unpacking, to ensure that the contents of the shipping carton are not damaged.
- 2.2 Install the unit in the place where it will be used. Care must be taken that this location provides satisfactory ventilation for the equipment. In order to ensure this, the unit should not be installed in a tightly enclosed space. Enough room must be available to permit free airflow across the equipment, especially the heatsink at the rear of the unit. If the unit is installed in an enclosed environment, sufficient air flow must be provided through vents, fans or other means. The amount of heat generated depends on the loop size, and wire gauge, but can be such that the reliability of the equipment will be reduced if the ventilation is poor. The equipment is designed to shut down when it overheats.
- 2.3 Prepare the input signal connection as described in section 3.
- 2.4 Connect the loop cable to the rear Loop Connector. Ensure that no stray wire ends protrude from the terminal. The polarity of the loop is not important, unless a specialised low-spill system is being installed. For the sizing of the loop, see the chapter on Loop Design. It is important that the loop cable ends form a twisted pair between the amplifier and the loop, to reduce the magnetic field near the amplifier position generated by the loop cable.

3. INPUT SIGNAL SOURCES

3.1 The equipment can be driven from various sources, such as P.A. systems, any other audio system or separate microphone preamplifiers. In all these cases, the Line Input socket must be used.

3.2 Line Input.

This input to the equipment is a balanced line high impedance input connection, which also permits single-ended operation. The connection is made via a 2-pole (unbalanced) or 3-pole (balanced) 6.3mm jack plug. Unbalanced inputs must use less than 3 metres of cable.

To prevent earth current loops causing hum effects, it is usually best to use the balanced input mode, coming from a single-ended signal using a good quality two-core plus screen cable as shown in the figure below. The connector sleeve is connected to the screening braid, the ring connected via one of the two cores to the source ground, and the tip to the source signal. If hum is encountered, then the earth lift switch can be used to disconnect the amplifier signal circuits from the AC power ground.

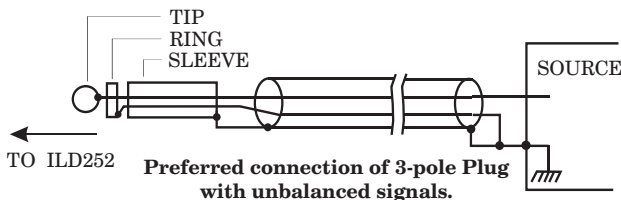
3.3 100 Volt Line

The ILD9 can be connected to a 100V line system via the ATT100 adaptor. This allows any line configuration, from single-ended to balanced mode. The leads from the 100V speaker line are wired to the connector which plugs into the adaptor, which is plugged directly (no extension cable!) into the Line Input socket.

Similarly, the ATT30 can be used to connect the ILD9 to a low-impedance speaker system.

3.4 Microphone Modules

The equipment can be used with separate microphone pre-amplifiers, which are available in different configurations (see data sheet for details). The power for these amplifiers can come from the Pre-amp Power socket, and the pre-amp output is connected into the Line Input socket. To ensure EMC immunity, cable length should be less than 1 metre.



3.5 Slave (I/O)

The insertion of a 6.3mm 3–pole jack breaks the link between the input stage / compressor and the power driver. The tip of the plug will be the preamp output (after compression) and the ring connection is the input to the power amplifier (see below). This connector is mainly used for the connection of the special signal processor used in low–spillover loop installations where the master unit controls the signal gain, and the slave unit operates purely as a power driver. This is essential to ensure full tracking between amplifiers. ***Under no circumstances should this input be used as a normal input***, as this bypasses the automatic compression.circuit. This compression is essential to the correct operation of other circuits which prevent RFI generation. Cable length must be less than 3 metres.

4. SIGNAL OUTPUT FACILITIES

4.1 Slave (I/O)

The output on this connector is the signal needed for driving equipment used with low–spill systems (see 3.5). It is also valuable for driving other audio equipment such as tape/cassette recording equipment, as the signal has been processed by the compressor, and therefore the dynamic range of the signal is reduced by the amount of compression. This can also be understood as an automatic gain control network. To obtain this recording facility the tip and ring of the 3–pole jack plug must be electrically joined. Do not use 2–pole plugs.

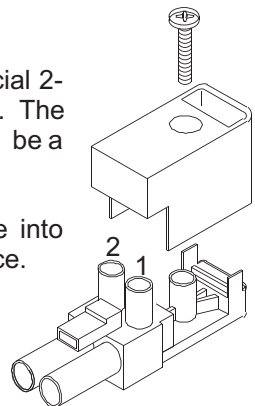
4.2 Headphone Monitor (on rear panel)

This jack socket permits the connection of standard, good quality stereo headphones for monitoring the current in the loop. The headphones are at this point connected in parallel with the loop current sensing resistor, which is of very low value (75 milliohm) and therefore what can be heard at this point is exactly the current which is fed into the loop.

4.3 Loop Output

The loop itself is connected to the ILD9 via a special 2–way connector, capable of handling the current. The cable from the loop to the amplifier should normally be a twisted pair.

- Remove screw from top of plug, remove cover.
- Insert Black wire into terminal 1, and Red wire into terminal 2, and tighten screws to secure wires in place.
- Replace cover and refit screw.



5. LOOP DESIGN

The design of the induction loop is very important for the satisfactory operation of induction loop systems. A number of parameters must be taken into account, and the following design procedure will provide the correct loop in many installations. It must be stressed that there are sometimes unusual circumstances that demand unusual solutions, and the installer should then take great care over the design and installation aspects. The following instances are typical of the situations which occur.

- ◆ Rooms where the shape is not a regular rectangle, such as T-shaped buildings, ovals, etc.
- ◆ Buildings with heavy metal reinforcement in their structure, which can seriously affect the magnetic field.
- ◆ Theatres with balconies.
- ◆ Rooms where the loop is displaced a long way from the listening plane.
- ◆ Buildings where several independent loops must be installed in close proximity such as multiple conference rooms without interfering with each other.
- ◆ Rooms which are subject to heavy disturbing magnetic fields (close proximity of electricity supply transformer stations, etc.). Ampetronic have an advisory service which can assist with solutions to these problems.

5.1 Loop Position

For optimum evenness of magnetic field, it is advisable that the loop plane should be displaced from the normal hearing (listening) plane by some 12–16% of the smallest dimension of the loop (width). Thus for a room 10 metre wide (30 ft), the optimum loop position is from floor level to 0.4 metre (22") below, or some 2.4–2.8 metres (8–9 ft) above floor level. With some degradation, the figures can be 8% to 25%, and this should cater for all most installations.

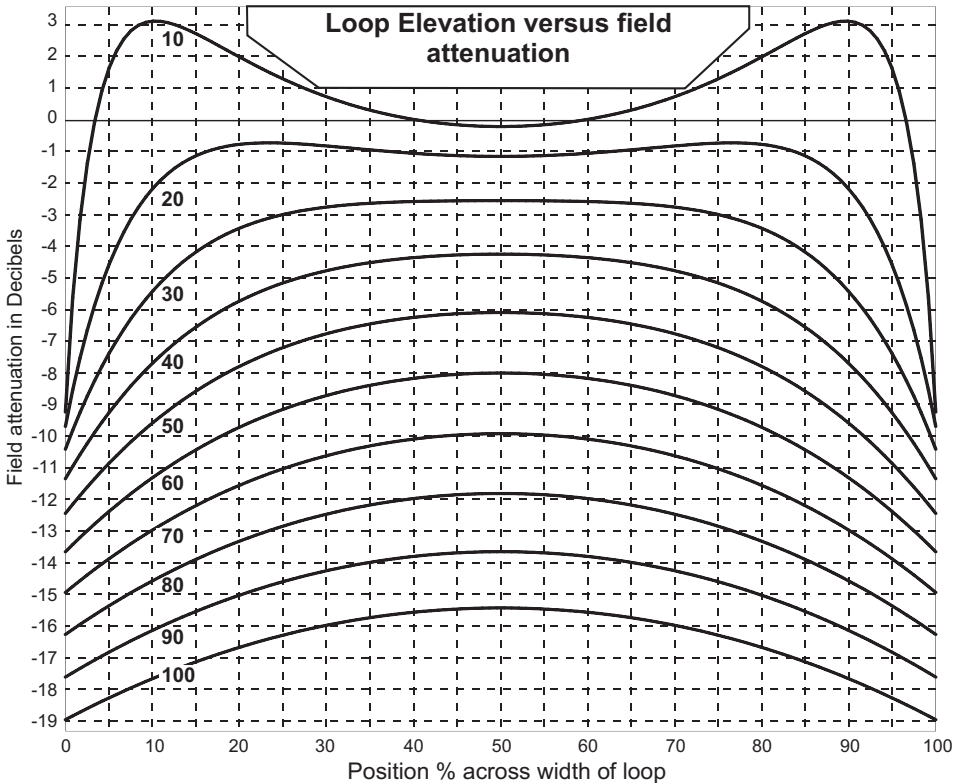
If the displacement is large, then consult the graph on this page, which gives the field distribution against loop elevation in %, and offers a guide to the extra power needed to achieve correct field strength. Often, a ceiling mounted loop may simplify the installation to an extent that the extra power needed is actually economical.

The position and size of the loop can also be affected by the position of the listening area (often much less than the full room size), the position of the microphones and other equipment that might be affected by the magnetic field of the loop (such as electric guitars without humbucker coils).

If dynamic microphones are used, they should preferably be used outside the loop, or if this is not possible, the actual loop cable should be kept as far away as possible from the microphone to prevent feedback due to magnetic coupling. (a distance of at least 1 metre / 3½ ft is advisable). Some dynamic microphones have better shielding than others, but this can only be established by practical assessment. The use of capacitor /

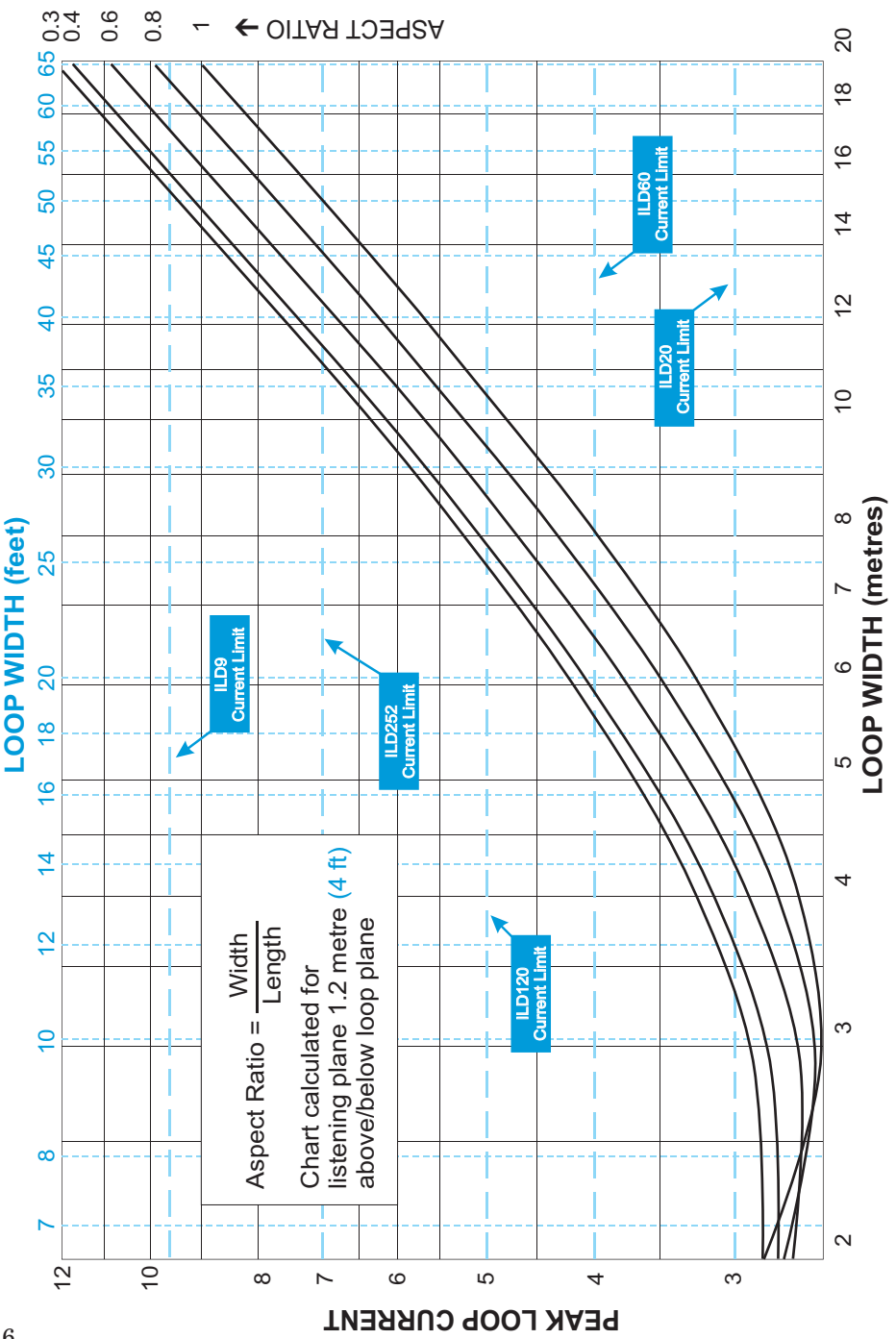
electret microphones often reduces this problem, but does not always remove it.

Microphone connections should always be via good quality balanced and screened cable to reduce pick-up. They should not run parallel with the loop cable when in close proximity. Wiring inside Junction and splitter boxes is very important, as open loops are very susceptible to magnetic pickup.



5.2 Loop Size and Current

Having defined the minimum area that must be covered, obtain the dimensions of this area, which for the sake of simplicity we will consider to be a rectangle. If the area is not an exact rectangle, then take the width and length of the largest portion of the loop area. Note length L and width W . Using a calculator, calculate the aspect ratio W/L (note that L is the larger of the two measurements). Using this aspect ratio figure, and the width, consult the chart printed on the opposing page. If the aspect ratio is not a value shown on the chart, then interpolate between given values. The intersection of the "aspect ratio" curve with the "width" line will give the peak current needed in the loop to satisfy the $0.4A/M$ peak field strength



requirement. It must be noted that the chart is computed for a listening plane that is offset from the loop level by 1.2 metre (4 ft). This is the normal case for a loop at floor level, as this equipment is generally used in rooms with seated listeners. If the chart indicates a current that is more than the peak current of the ILD9, then a multi-driver system will be required. This is also true where significant amounts of metal are present, such as large areas of reinforced concrete floor as these absorb energy in a frequency dependent manner.

Losses due to metal normally approach 3 dB per octave, with a lower corner frequency anywhere between 150 Hz and 0.02 Hz. This latter loss is found in all-metal rooms on ships, etc.

A special metal loss corrector will be needed in such circumstances. Several of the Ampetronic Loop Drivers already incorporate this facility. Substantial extra power will generally be required to obtain the necessary performance. Full current is needed to at least 1.6 kHz, sometimes even 2 kHz. With the loss rate as given above, this may represent a significant extra power.

Generally, most reinforced concrete floors need up to 6 dB of extra current. Please contact Ampetronic for assistance in all these situations.

5.3 Choice of loop Cable

Please note that Ampetronic Loop Drivers have been designed to operate into **single turn loops**, and must not be used with old-fashioned multiturn loop layouts. **Unusual or special loop layouts may only be used with the express approval of Ampetronic Ltd. to ensure compliance with all technical standards.**

The maximum DC resistance of the loop (including feed cable) for a loop connected directly to the Loop Driver should be less than 2 Ohm for optimum performance, and should be greater than 0.3 Ohm. When a current ratio unit is used, then Ampetronic Ltd. must be consulted. Maximum cable length for these limiting resistances is as follows:

Cable size section	Minimum length (m)	Maximum length (m)	
0.5 mm ²	12	59	
0.75 mm ²	18	88	
1 mm ²	24	118	
1.5 mm ²	36	160	Note 1
2.5 mm ²	60	175	Note 1
4 mm ²	95	191	Note 1
1.8 mm ² flat cable	43	245	Note 1

Note 1: value defined by maximum impedance at 1600 Hz, affecting frequency response. Consult Ampetronic for further advice.

Normal stranded, or solid-cored cabled can be used. A suitable cable for most applications is standard "Tri-rated" cable to BS6231, CSA, UL

approval. The flat cable is available from Ampetronic for installation under carpets.

The values given in the table include the resistance of the feeder cable, but of course the inductance of this feeder is normally very low.

Feeder cable should always be twisted to ensure that the magnetic field near to the equipment is kept low. Shielded cable has no real advantages as magnetic radiation is not affected. Parallel wire cable (figure of 8) as used for some loudspeaker systems is not recommended. Very often, the wire gauge of the feeder will be similar to the actual loop cable. Please ensure that the total DC resistance of loop and feeder cable does not exceed the maximum DC value specified above. The actual feeder length is double the physical length for resistance (send and return).

For very long feeder cables, the recommendation is to use a 4-core round cable in "star-quad" configuration. Optimum cable size is 1.5 / 2.5 mm². The opposing cores are connected together, providing a very low resistance and inductance, with little radiation. This style cable is often used for 3-phase + earth power connection of machinery. UK style is 3184Y, harmonised H05VV-F. Total resistance of 100 metres of 3184Y cable, 2.5 mm² per core, is 0.69W. This is well inside the capabilities of the Ampetronic loop drivers.

5.4 Metal Loss

Modern building construction often includes a large amount of metal in the structure, including mesh in reinforced concrete floors and ceilings. Under some circumstances this can be a serious problem, as hysteresis losses in this metal cause a loss which is frequency-dependent. The actual value of the loss can only be found by measuring the site performance. Ampetronic have significant experience in this area and should be consulted prior to installation if a significant amount of metal is likely to be present. The loss varies from 0 to 3 dB per octave, with a lower corner frequency between 100 Hz and 0.01 Hz. As such, the loss in the middle frequency band can be very significant. A corrector is build into the amplifier to correct the frequency response, but the power loss can only be overcome with additional power into the loop. This may require additional driver amplifiers.

6. LEVEL ADJUSTMENT

6.1 Initial setting up

During the initial commissioning of the equipment it is essential that the following procedure be used to ensure a satisfactory end result. Turn the Gain and Drive controls fully anti-clockwise, i.e. minimum signal. Provide a continuous input signal, preferably from a small tape or CD player with wideband music, connected directly to the line input.

Ensure that all connections are made correctly, including power and loop.

Switch unit on. After a short time that green Power LED will stop flashing, indicating that the amplifier is working correctly.

Increase the GAIN until 2 of the compression LEDs are just illuminated under peak signal conditions. This establishes a reference level for the output power driver. Increase the DRIVE setting until the desired output current is achieved (section 5.2). If no reading is obtained, check for loop continuity. Where the current needed is a value between two LED readings, position the control by interpolating, bearing in mind that consecutive LEDs illuminate at 3dB intervals. Having achieved this setting of the DRIVE, check with headphones plugged into the monitor output socket that a satisfactory sound quality is obtained from the loop current. If a standard field-strength measuring unit is available, then check that the field has the correct strength. From this point onwards, the DRIVE control will not need re-adjusting, as this only affects the peak field strength.

Before connecting to the audio system, check the entire sound system for crosstalk from the loop into the audio inputs. While still playing a music tape directly into the loop driver, check every audio system input circuit, and if a significant amount of signal is picked up, then correct the wiring. This ensures adequate stability for the complete system.

Connect the cable from the audio system to the line input, and readjust the input gain control for optimum compression.

6.2 Adjusting Metal Loss Correction.

Correct adjustment of the frequency response requires the use of specialised test equipment to measure the frequency response of the system, as specified by international standards (such as EN60118-4 and IEC118-4)

A simple method is to listen to the sound with a good quality receiver such as the ILR2. Using the same headphones, listen first to the loop current signal obtainable from the Loop Monitor outlet on the ILD9 with metal loss correction set to minimum.. Then listen to the loop signal using the ILR2 and adjust the "Loss Correction" to obtain a similar sound quality.

A full plot of the actual response can be made with suitable equipment, using the CMR2 calibrated receiver. This can be done with Pink Noise, or a frequency sweep (which must be done at 20dB below normal maximum loop current). Please contact Ampetronic Ltd for further advice.

6.3 Setting of GAIN control - Optimising Compression

To obtain the greatest possible dynamic control range from the compressor, it is now necessary to establish the highest level of input signal which the equipment may receive in the operational installation. This will often be loud, close talking into a microphone. If the GAIN is adjusted so that the red OVERLOAD LED does not illuminate, (just), then the compressor will maintain the highest possible level into the loop for

faint speech, etc.. Monitoring with the output headphones will indicate the clarity of the signal under all levels of compression. It should be pointed out here that background hum and noise from equipment earlier in the chain, such as a PA. system may sound very troublesome when subjected to some 18-24db extra amplification. When this occurs, the gain must be kept at a lower, acceptable level. This may also have to be done in the case of marginal magnetic feedback via dynamic microphones, etc. Where the dominant signal is music, then it may be important to keep the compression level low, to prevent serious degradation of the music dynamics. Experience will indicate which level to use. REMEMBER: once the DRIVE control has been set, only adjust the GAIN control, as otherwise the correct operation of the system is impaired.

7. GENERAL INFORMATION

7.1 Difficulties

If you have any difficulties in calculating the loop design, or experience difficulties with the operation of the equipment, then contact your supplier or Ampetronic Ltd. It is useful to have all the relevant data available when contacting our technical staff who will be pleased to help you.

Please have the following information available:

Loop dimensions, loop position, conditions under which problem occurs, building usage, equipment type.

The following are known trouble areas:

- Strong hum field, mainly from fluorescent light fittings, or electrical wiring where current flow and return are not in the same cable or duct.
- Electric guitars used in single–coil mode. Twin coil/humbucker mode is generally necessary to prevent pickup of the loop signal into the guitar.
- Loop cable installed where it is in close proximity to microphone (or other audio) cables for an appreciable length. Telephone cabling can also be very sensitive to this coupling.

7.2 Fuses

A 20mm fuse is incorporated in the rear panel power input socket. It is necessary to remove the power cord before extracting the fuse holder. The fuse rating and type are printed on the rear panel.

7.3 Ventilation – Overheating

Section 2.2 indicates the necessity for good ventilation of the equipment. Under unusual load, the heatsink temperature can rise to nearly 100°C, and therefore good ventilation is essential to remove up to 150 Watts of heat. Furthermore, provision should be made for restricting the access to the heatsink, to protect people. If the heatsink rises to the indicated temperature, an internal sensor will shut the equipment down until it has cooled to a safe value. In this condition, the equipment appears as if it is

switched-off, no power indication at all is available.

7.4 Internal self-test

An internal self-test system has been incorporated in the equipment. When switching on, the power LED will flash for some 5 seconds, during which time the amplifier is tested for correct operation. If OK, the unit will switch to an operational mode, when the LED will remain on. However, if a major fault exists, the equipment will return to a safe mode, and the LED will flash continuously. Please contact your equipment supplier or Ampetronic Ltd.

7.5 A rackmount kit is available for installing the unit in a 19" standard rack. This is fitted using the side screws which retain the covers.

7.6 **WARNING - THIS APPARATUS MUST BE EARTHED.**

8. TECHNICAL SPECIFICATION

8.1 Line Input:

Impedance 1M each side, 2M differential.

Sensitivity: 7mV to 2.6V rms (-40dBu to +10dBu).

Balanced signal line. 6.3mm 3-pole jack socket Can be used unbalanced with mono plug.

Common mode rejection better than 50dB below 500Hz.

8.2 Slave Input / Output

Input Impedance 100k Sensitivity 1V rms, +2.2dBu.

Source Impedance 220 Output level 1V rms +2.2dBu.

Signals are unbalanced, with a 3-pole jack socket used as an insert point. See chapter 3 for connections.

8.3 Metal Loss Correction

Loss correction adjustable from 0 to 3dB per octave.

Gain remains constant at 1 kHz. Lower frequencies are attenuated.

Higher frequencies are boosted.

8.4 Loop Current:

9.6A Peak signal current into a SINGLE TURN loop. Metering via front panel LEDs. These LEDs indicate the peak current, with intervals of 3dB.

8.5 Loop Resistance:

Must be less than 2 Ω , greater than 0.3 Ω .

8.6 Compression:

Compression range 30dB before overload. Front panel indication of compression level. Efficiency: less than 0.25dB output change for 25dB input change.

Attack and Decay time constants optimised for speech.

- 8.7 Frequency response:
80Hz to 10kHz ± 1.5 dB at low level, measured as loop current. High frequency high signal level response is a dynamic variable and is a function of loop size, loop current and signal content to ensure that no RFI generation takes place. Internal time constants are very short.
- 8.8 Pre-amp power:
 ± 15 V DC regulated output, up to 0.3A.
- 8.9 AC Power input:
230V AC nominal, 45-65Hz. 160 VA.
Fuse fitted in input connector T 1.6A L
Factory setting for 115V available..
- 8.10 Dimensions : Length: 432mm Depth: 220mm Height: 88mm (2U)
- 8.11 Weight: 5.5kg.

The ILD9 is designed and manufactured in England by Ampetronic Ltd.

DECLARATION OF CONFORMITY

Manufacturer: Ampetronic Ltd.
Address: Northern Road, Newark,
Nottinghamshire, NG24 2ET.
United Kingdom.

Declares that the product:

Description: Induction Loop Driver
Type Name: ILD9

Conforms to the following Directive(s) and Norm(s):

Directive 89/336/EEC
EMC: EN55103 (1 & 2) 1997
Directive 73/23/EEC
Safety: EN60065 (1995)

September 2000

L.A. Pieters
Managing Director
Ampetronic Ltd.