AMPETRONIC

HLS-2D
Metal Loss Test
Procedure

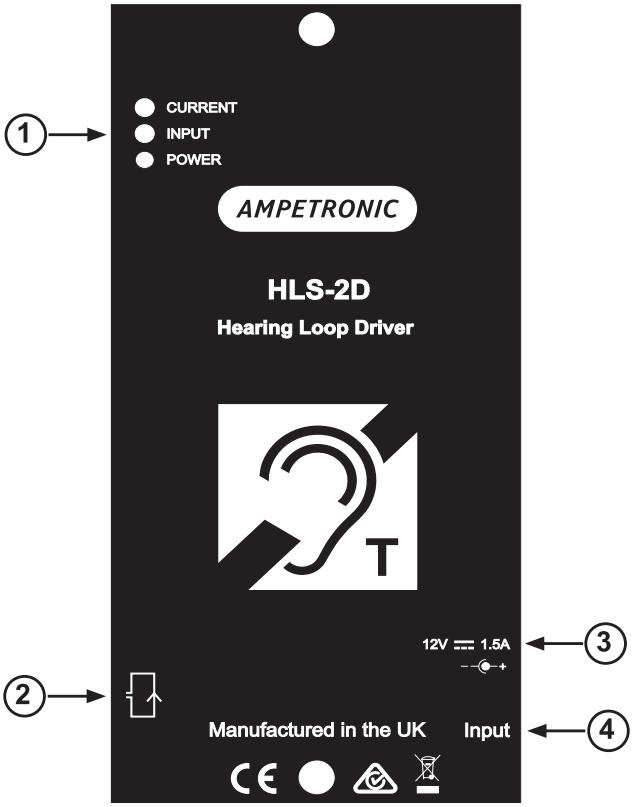
www.ampetronic.com

Document outline

Determining metal loss and background noise levels are important steps in designing a proper hearing loop system that meets the IEC 60118-4 international standard.

This test procedure uses the HLS-2D loop driver which is mounted in a compact rugged case and pre-set to simplify and reduce set-up and testing time.

The document will guide you through the metal loss and background noise testing process utilising either the R1 Loopworks Measure Receiver, or the FSM (field strength meter).



Test kit contents

- HLS-2D loop driver
- 12V DC power supply
- 2 x 4mm connector plugs for the loop cable (cable not supplied)
- 3.5mm audio cable

1. Separate indication for power, input signal and loop current

2. Loop output connectors using standard 4mm banana plug test sockets

3. 12V DC power input, 2.1mm centre positive

4. Audio input, 3.5mm stereo jack

Additional equipment required

- R1 Receiver with iOS Device and Loopworks app or FSM with test record sheet
- Signal source - mobile phone, MP3 player or signal generator, with Ampetronic test tones
- Loop cable - 25 to 30m (80-100ft) of 1.5mm^2 (AWG 16) single core wire fitted with supplied connectors
- Tape measure

Test signals and record sheet template available from www.ampetronic.com/signals

Optional equipment

- True RMS multimeter to monitor output current
- Additional short link cable (2x4mm connectors) if multimeter is used
- 12 volt battery (a fully charged 12 volt 4800mAH battery will give approximately 8 hours of testing time)

Technical Specifications According to IEC 62489-1:2010 Standard

PARAMETER		VALUE
Max area coverage		45m^2
Power supply range		12-24V DC
Fuse		PTC resettable 1.5A
Current consumption (12V DC)	Continuous pink noise	240mA DC
	Quiescent	50mA DC
	Quiescent (Power Save mode)	14mA DC
	Short term peak	1200mA DC
Sensitivity Input 1 - Line		-16dBu
Sensitivity Input 2 - Line		-16dBu
Overload (Line channels)		+22dBu
Current (into rated load)	Sine 1kHz	>3A_{RMS}
	Pink Noise	>1.5A_{RMS}
Frequency response (0.6$A_{RMS)}$		100Hz to 5kHz ± 1.5dB
Compliance voltage		4.2V_{RMS}
Weight		272g
Dimensions		77 x 150 x 16mm
Connectors		4mm banana plug sockets
Environmental		IP40, -30°c to +75°c, <90% relative humidity
Typical heat dissipation		<3W

WARRANTY

This product carries a five year parts and labour warranty from date of shipment from Ampetronic. To qualify for the five year warranty, the product must be registered at www.ampetronic.com (products/warranty), without which the warranty will be valid for two years only.
The warranty could be invalidated if the instructions in this handbook are not followed correctly, or if the unit is misused in any way. ***Note:*** *The PSU and connectors supplied with this product are only covered by manufacturers warranty period.*

Choosing an area coverage loop system

There are two types of loop systems for covering a room or area although assuming that a perimeter loop is suitable is a good starting point as it will give you the least complex option and make installation easier and cheaper.

Perimeter loops are suitable:

- when no spill control is required and
- there is less than 6dB variation between high and low signal readings across the field.

MultiLoop™ systems are preferred for:

- **Loss control:** - Where there is >6dB variation, a figure of eight test loop is recommended, with loop wires 2-4m (6.5 – 13ft) apart. Buildings with high concentrations of metal will typically require the use of narrower loops, although loops wider than 4m may be possible, subject to testing.
- **Spill control:** - Where control of overspill is required for confidentiality or the presence of adjacent spaces, a figure of eight test loop is recommended, but loop width should be limited to 2.0-2.5m (6.5-8ft).
- **Large areas:** - The signal in a floor-level perimeter loop wider (in the narrower dimension) than 15m (50ft) will vary greater than 6dB even with no metal content. Elevating the loop or using a MultiLoop™ system will correct this. There is no restriction on the width of the test loop below 15m (50ft) and the designed loop width is likely to be dictated by installation practicalities e.g. aisle placement.

Additional considerations:- The presence of fixed metal furniture and/or tiered seating may define the positions where a loop can be practically installed. If a perimeter loop cannot be used, the size of the figure of eight loops should be determined by the fixed features, e.g. loop widths should cover 2-3 steps with a 1 step gap.

Set-up procedure

Determine test loop location

Step 1. The test loop should be placed within the intended area to be looped and positioned at the same height at which the final loop will be installed.

Step 2. Take note of the construction of the area to be looped and ensure the test loops cover all the various structural elements. The test loops should cross over any steel beams or large ducts that may be present. If the area to be looped is very large, for example a large theatre, repeat the test in multiple areas throughout the space to account for variances in building structure.

Step 3. Complete a separate site assessment procedure, or a metal loss test form for each test area and note the location of each test.

Perimeter Loop layout test loop

If a **perimeter loop** is going to be installed, then test with the actual intended loop layout.

Driver set-up

A. Connect the power supply (or battery), signal source (phone or MP3 player) and loop wire.

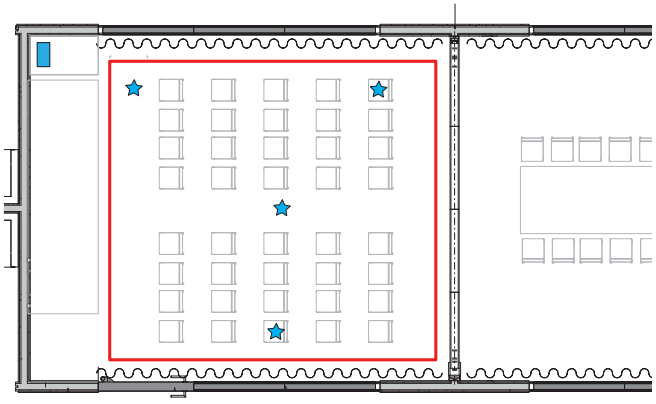
B. If using a multimeter this should be connected in series, using the high current connections and set to the AC current option.

C. Switch on the power to the driver and check that the power LED illuminates, the Input LED will also light up for a few seconds as the circuit settles.

Signal level test set-up and test positions

Set the signal input to sinewave or combination and turn up the volume of the signal input until the input LED lights light up on the driver.

NOTE: continuous prolonged use of a sinewave signal (longer than 10 minutes) will cause the output current to drop slightly, however this should not affect the output level by more than 1dB. The combination signal avoids this.The current LED should also be on at this stage.



For **perimeter loop** tests, readings should be taken in the middle, edge and near to at least one of the corners of the loop, to measure the maximum variation in signal strength across the loop.

All testing positions should be at least 1m (3ft) from the wires, as the signal level decreases near to the wire, making readings unreliable.

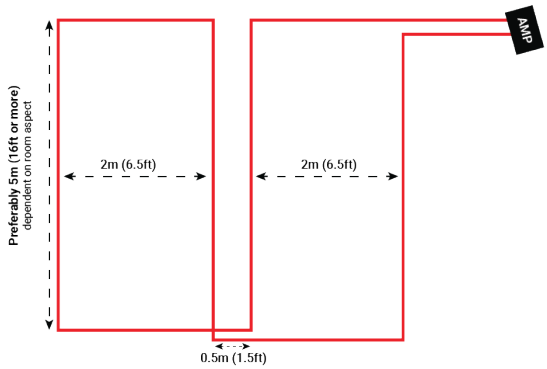
Measurement height for the test meters should be at 1.2m (4ft) from the floor (typical seated head height), whether the test loop is on the floor or ceiling.

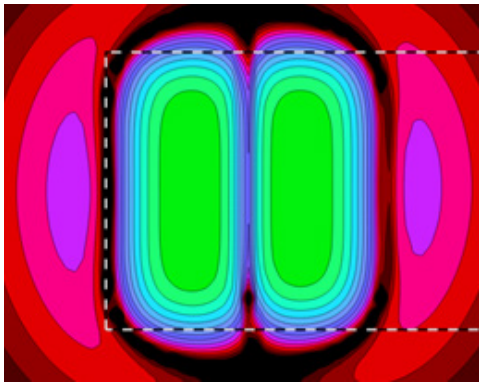
All measurements must be carried out with the Loopworks Measure R1 or FSM positioned vertically.

MulitiLoop™ layout test loop

If the intended installation will be a **low spill or loss control MultiLoop™** this should be a figure eight as shown below.

It is better to use the least amount of wire to make the test loop. Any extra wire should kept away from the loop and folded back on itself rather than coiled to avoid interference to the test.





For a floor level wire, the suggested dimensions will achieve 0dB in the centre of each loop if there is no loss and will match most Loopworks™ designs, however larger loop segments can be used if the intended design and installation is likely to require this.

Take some photographs of the loop layout for reference.

Driver set-up

A. Connect the power supply (or battery), signal source (phone or MP3 player) and loop wire.

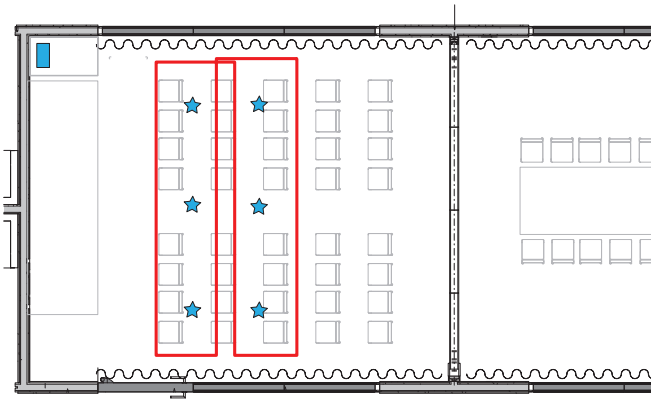
B. If using a multimeter this should be connected in series, using the high current connections and set to the AC current option.

C. Switch on the power to the driver and check that the power LED illuminates, the Input LED will also light up for a few seconds as the circuit settles.

Signal level test set-up and test positions

Set the signal input to sinewave or combination and turn up the volume of the signal input until the input LED lights light up on the driver.

NOTE: continuous prolonged use of a sinewave signal (longer than 10 minutes) will cause the output current to drop slightly, however this should not affect the output level by more than 1dB. The combination signal avoids this. The current LED should also be on at this stage.



For **MultiLoop™ systems** measurements should be taken in the centre of the loop. In larger rooms use more measurement positions to make sure loss levels are consistent across the area.

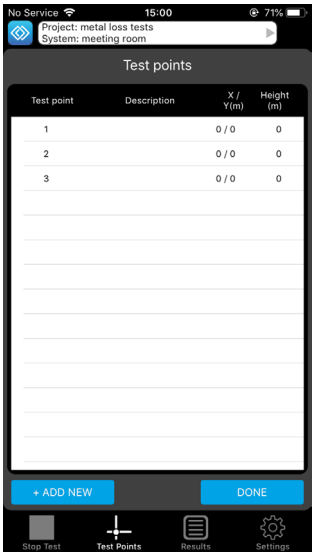
All testing positions should be at least 1m (3ft) from the wires, as the signal level decreases near to the wire, making readings unreliable. If space is restricted, a single loop can be used; however, this is a less accurate representation of performance.

Measurement height for the test meters should be at 1.2m (4ft) from the floor (typical seated head height), whether the test loop is on the floor or ceiling.

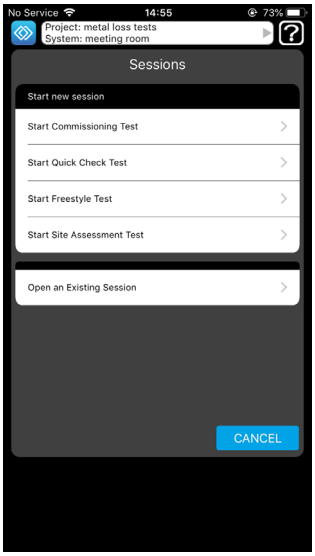
All measurements must be carried out with the Loopworks Measure R1 or FSM positioned vertically.

Tests with the R1 receiver and Loopworks Measure app

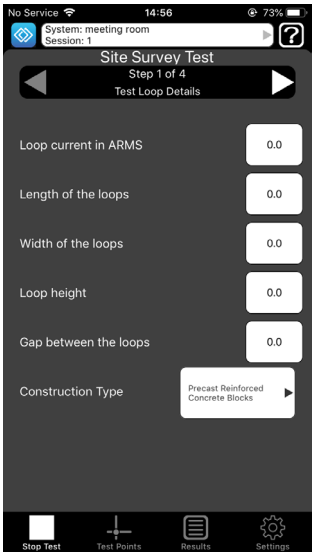
Open the app and connect the R1 to your device, select or create a project and system.



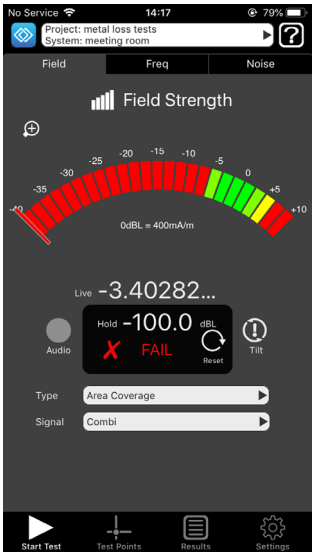
Define test points



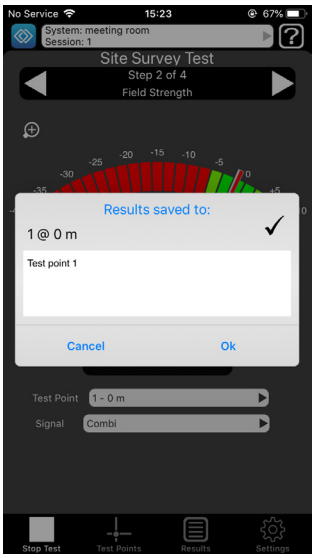
Start Test, Start Site Assessment Test then name session



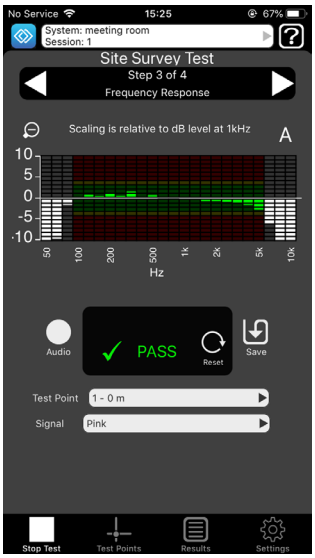
Fill in test loop details, loop current is preset to 2.5A



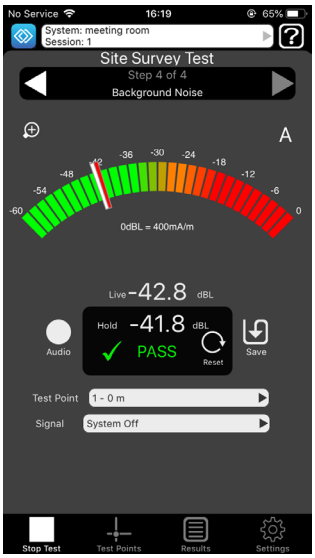
Select Field Strength, wait for sinewave peak if using combination tone



Save a result at each test point, make sure to reset the peak hold



Change the input signal to pink noise, save a frequency response reading at each test point



Turn the HLS-2D driver off, save a background noise reading at each test point

Press Stop Test to finish the measurement.

You can now log on to your Loopworks account online and open the measurement session, download a PDF report of the data and either follow the interpreting results section or send it to Ampetronic or your local distributor for analysis.

Test with FSM meter

Step 1. Record the details and dimensions of the test loop on the form.

Step 2. Select the Field Strength setting (middle mode of the lower switch), move to the first test position and measure the signal level on the white scale.

Step 3. Record the signal level on the test sheet and repeat this for all the test points.

Step 4. Change the input signal to pink noise.

Step 5. Switch the meter mode to Frequency Response.

Step 6. Select the 100Hz band and record the signal level as shown on the white scale, switch to 1kHz and repeat, then to the 5kHz.

Step 7. Repeat these measurements at all the test points and record all the results on the attached record form.

Step 8. Turn the HLS-2D driver off, switch the meter mode to Background Noise and record the reading from the green scale at each test point.

Step 9. Follow the interpreting results section or send a copy of your completed form to Ampetronic or your local distributor for analysis.

Interpreting Results

Perimeter loop test for metal loss

If the difference between your highest and lowest test reading is more than 6dB a perimeter loop installation would not be able to meet the requirements of the IEC 60118-4 performance standard. If possible, carry out a figure eight test to check if a loss control MultiLoop™ array would be more suitable.
To calculate the metal loss create a perimeter loop of the same specification in Loopworks Design and on the Outputs > Variation tab change the 'Manual adjustment' field until the Base current reads 2.5A. Determine the largest difference between your test results and the simulated field strength, this is your 'loss figure'.
Return the 'Manual adjustment' field to 0dB and then enter your 'loss figure' into the 'Use manual loss figure' field on Inputs > Design.

Figure of eight test for metal loss

For a figure of eight test with loop segments of between 2m (6.5ft) and 4m (13ft) width, the expected field strength will be approximately 0dB, so the test result will be your metal loss value.
If an initial figure of eight test shows very little loss (< 4dB), try testing again with larger loop segments as this may allow a more efficient installation, especially in larger spaces.
In Loopworks Design, assuming the loop segment widths on the design match your test loop size, your test result can be entered into the 'Use manual loss figure' field on Inputs > Design to specify the most suitable amplifier.

Interpreting frequency response

Correcting the frequency response is not normally an issue in multiloop systems, as long as there is sufficient voltage headroom allowed in the amplifier.
Often it is possible to get much better results with Ampetronic dual slope MLC, as found on all our network enabled drivers.
These drivers will allow up to 4dB/oct correction, so would compensate for a test 5kHz reading down to -9dB (re. 1kHz) and a 100Hz reading of up to +13dB (re. 1kHz).

N.B. large MLC slopes require more headroom, a 4dB/oct correction could require up to an additional 4dB of voltage headroom in the loop driver.

Perimeter loops can be more difficult, as the frequency response can vary more across the area, eg. the effects of metal loss are usually more significant in the middle of the loop, causing more frequency loss.
If there is a lot of variation between slopes across different test positions (in general more than 3dB difference between the high or low readings, across multiple test points) then there may not be a suitable MLC slope that could correct for all of these and a system with smaller loop segments could be required.

If in doubt, contact Ampetronic or your local distributor for more in depth analysis of your frequency results.

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EC Declaration of Conformity

Manufacturer:	Ampetronic Ltd
Address:	Unit 2, Trentside Business Village Farndon Road Newark NG24 4XB

declare that:

Equipment	Induction Loop Driver
Model name / number	HLS-2D

in accordance with the following directives:

2014 / 35 / EU	The Low Voltage Directive (LVD) and its amending directives
2014 / 30 / EU	The Electromagnetic Compatibility Directive (EMC) and its amending directives
2014 / 53 / EU	The Radio Equipment Directive (RED) and its amending directives
2011 / 65 / EU	The RoHS Directive and its amending directives

has been designed and manufactured to the following specifications:

LVD Safety Standard:

EN 60065:2014 +A11:2017	Audio, video and similar electronic apparatus – Safety requirements

RED Standard:

ETSI EN 303-348 V1.1.1	Induction loop systems intended to assist the hearing impaired in the frequency range 10Hz to 9kHz

EMC Standards:

EN 55032:2015	EMC – Product family standard multimedia equipment: Emission
EN 55103-2:2009	EMC – Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use – Part 2: Immunity with respect to electromagnetic environments: E1 – E5

I hereby declare that the equipment named above has been designed to comply to with the relevant sections of the above specifications. The unit complies with all essential requirements of the Directives.

Date: **May 2019**

Name: **J.R. Pieters**

Position: **Managing Director**

CE

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