

## Inductive Loop Design

### Design criteria

Compliance with IEC60118-4

- |                           |   |
|---------------------------|---|
| → Flat frequency response | ±3dB within 100 – 5000 Hz range<br>(Relative to 1kHz) |
| → Average field strength  | 100 mA/m ±3dB<br>(70-140 mA/m)                        |
| → Maximum field strength  | 400 mA/m  |
| → Dynamic range           | <12dB   |

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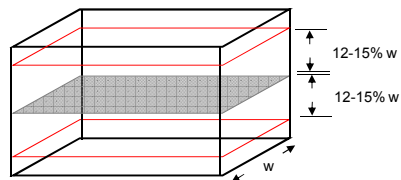
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## Inductive Loop Design

### How it works in practice

- Create loop around listening area
- Max 12 meter wide (w)
- Max area 600 m<sup>2</sup>
- Mounted on the floor or ceiling
  - Distance from ear level ±12-15% of width (w) (calculate that!)
- DC resistance between 1 and 3 Ω
  - Cable diameter according to table



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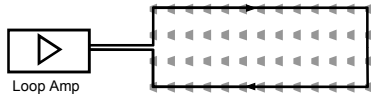


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**Inductive Loop Design**

### Single loop design



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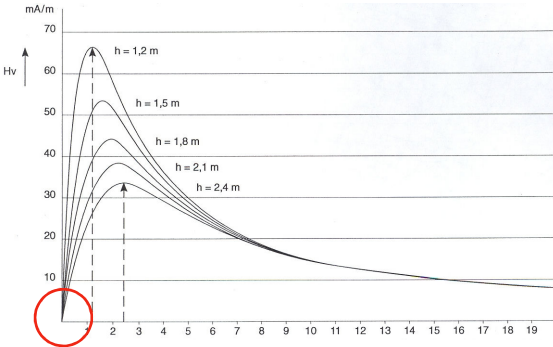
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### Single loop design

→ Field of a single conductor:



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### Inductive Loop Design

## Single loop design

**Max 12 meter wide (w) !**

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### Inductive Loop Design

## Loop design calculator

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### Inductive Loop Design

## Loop design calculator

**Room parameters.** (calculation field)  
 The start point of the loop always start at 0,0  
 If you want to calculate the field outside the loop;  
*decrease the start point, increase the end point*

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### Inductive Loop Design

## Loop design calculator – default situation

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### Loop design calculator – the first exercise

The diagram shows a rectangular loop with a 'Loop Amp' symbol on the left. The vertices are labeled with coordinates: (0,0) at the bottom-left, (0,12) at the top-left, (20,12) at the top-right, and (20,0) at the bottom-right. Arrows indicate a clockwise direction of travel around the loop.

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### Loop design calculator: wide area

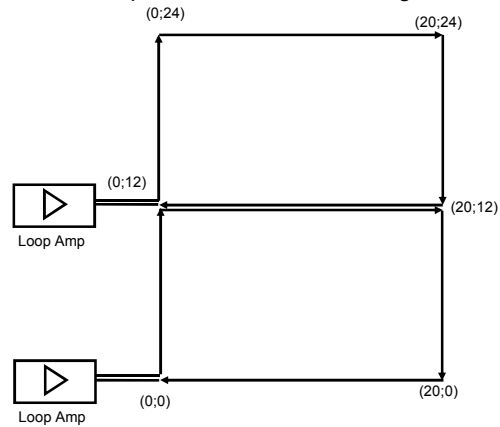
The diagram shows a rectangular loop with a 'Loop Amp' symbol on the left. The vertices are labeled with coordinates: (0,0) at the bottom-left, (0,24) at the top-left, (20,24) at the top-right, and (20,0) at the bottom-right. Arrows indicate a clockwise direction of travel around the loop. The text "This loop is not allowed... How to solve?" is centered within the loop's area.

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## Inductive Loop Design

### Loop design calculator: wide area with dual loop

→ 2 identical loops to increase the coverage ...



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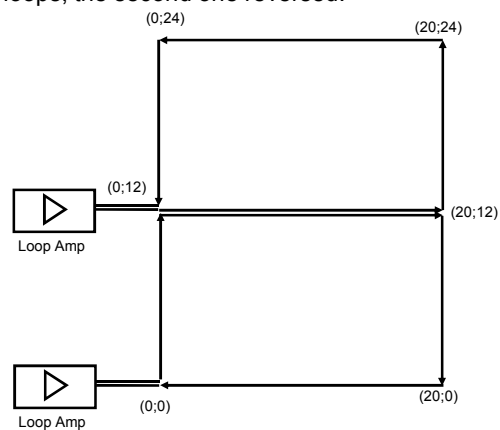
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## Inductive Loop Design

### Loop design calculator: wide area with dual loop

→ 2 loops, the second one reversed!



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**Inductive Loop Design**

Loop design calculator: wide area with dual loop

→ overlap to improve the coverage ...

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**Inductive Loop Design**

Loop design calculator: wide area with dual loop

→ overlap to improve the coverage ...

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### Inductive Loop Design

## Loop design calculator: meandering the (dual) loop

(0;24)
(20;24)

(0;12)
(0;12.5)
(20;12.5)
(20;12)

(0;11.5)
(20;11.5)

(0;0)
(20;0)

Loop Amp

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## Loop design calculator: an example

- 2 audience areas
  - 11 x 5 m.
- Aisle inbetween
  - 2 meter wide
- Best solution?

(c) EASE 4.1 / Church.typ / 31-1-2006 12:09:17 / Bosch Security Systems B.V. J. v.d. Watering

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Loop design example: alternative I

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Loop design example: alternative II

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**Loop design: influence on dynamic microphones**

→ Straightforward solution

Stage with microphones or guitars

AND...  
How did the dynamic microphone work?

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**Loop design: influence on dynamic microphones**

→ The alternative solution

Stage with microphones or guitars

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Loop design: no field required everywhere

Dynamic microphones

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Loop design calculator: wide area with dual loop

→ overlap to improve the coverage ...

Slave Loop Amp (0;12) (0;12.5) (20;12.5) (20;12)

Master Loop Amp (0;0) (0;11.5) (20;11.5) (20;0)

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## Inductive Loop Design

### Loop design: quadrature loops

- Create multiple loops without interference (increase or reduction)
- To cover larger areas
- To get a higher field strength
  - Compensate for metal loss
- To create low spillover schemes (= the effect of smaller loops!)

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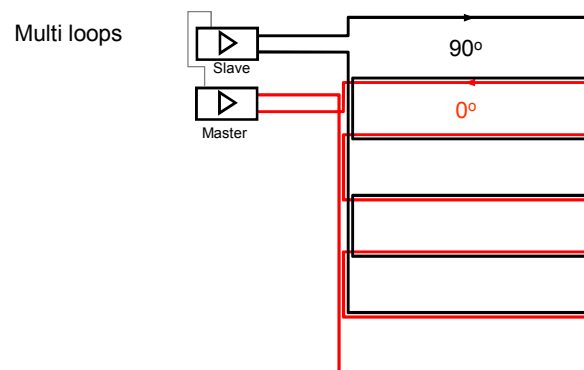
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### Quadrature System



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## Inductive Loop Design

### Quadrature loops – low spillover

#### → What?

- Multiple loops
- Small loops
- Some overlap (0.5 – 1 m)
- Outer loops smaller than the others

#### → How?

- Adjacent loop helps reduce spillover
- Dimension of loop is small, so dimension of spillover is small
- Lower current means lower spillover
- Mind the orientation

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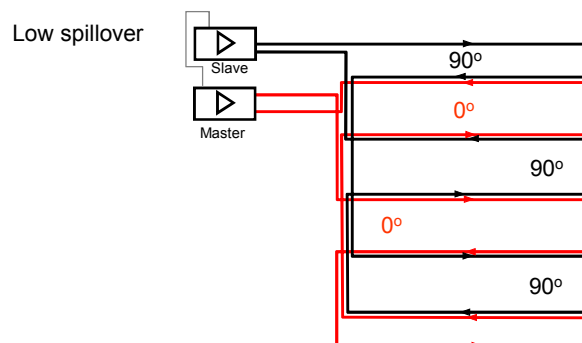
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### Quadrature System



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**Thank you for your attention**