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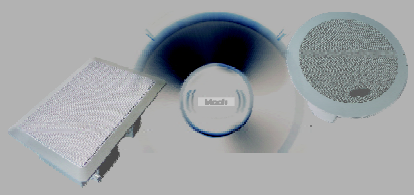
CEILING LOUDSPEAKERS

MACH SPEAKERS A/S PERSPEKTIVVEJ 2
9900 FREDERIKSHAVN , DENMARK

A MARTIN PROFESSIONAL PRODUCT

CEILING LOUDSPEAKERS
INSTALLATION GUIDE



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INTRODUCTION

Wherever we go it is normal for us to constantly hear messages. These messages are infinitely diverse from pleasant music to a tempting offer in a shopping centre.

It is becoming more and more usual for us to have a centralized sound system in our homes to create a musical environment to increase our comfort as much as we can in the little free time that we have available.

All this would not be possible without certain necessary elements. These elements are what we are going to deal with in this manual: **Public Address System Loudspeakers.**

Mach Speakers a/s, in an effort to meet all possible customer needs, has added to its wide product range a line of ***Ceiling Loudspeakers.***

Our objective here is simply to explain this field in a clear way and to facilitate installation.

We can separate the elements we need for a basic installation into two groups: active elements and passive elements. The former group contains amplifiers, signal frequency amplifiers, mixing decks, effects, etc.

Passive elements encompass speakers, cables, dynamic microphones, attenuators etc.

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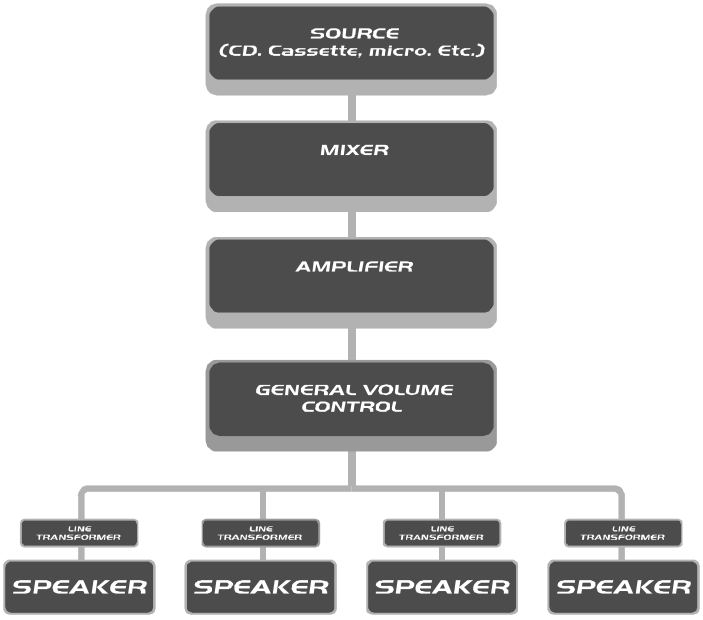
BASIC DISTRIBUTION DIAGRAM



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VOLTAGE LINES

It is usual in public address system installations to find that the signal has to travel over considerable distances. Logically, this is due to the fact that the speakers are separated from the source and also due to the large number of speakers that are sometimes used. There are some matters that we should bear in mind if we want to guarantee a successful installation.

When the distances are considerable, the cable's own ohmic resistance will absorb part of the line energy. We could say that the power in the charge (speaker) will be altered by the least energy provided by the amplifier as there is a greater impedance in the output terminals.

A possible solution could be to increase the section of the conductor, but this would not be viable if the distances are considerable or multiple connections are used, as costs would be high.

The solution is to increase the impedance in the speaker terminals with the consequent increase in the nominal line voltage in order to maintain the required values.

Public address system amplifiers adapt their output through transformers. Nominal voltage is generally 100 volts, although sometimes it may be 50 or 70 volts.

This voltage is not maintained permanently in the line. It only reaches this level when working at maximum power, so we can say that this is occasional and as the audio signal changes through modulation there are moments when there will be zero voltage when there is no signal in the line. There is, however, a constant voltage in the whole system when there is a message in all the speakers because there is no loss.

Once we know the voltage in our line, we have to adapt the speakers to it. If, for example, we have an 8 watt speaker, which is enough power for an installation, we will need an impedance of 1250 ohms to be able to connect it to a 100 volt line.

$$Z=\frac{100^2}{8}=1.250\ Ohm$$

IMPEDANCE TRANSFORMERS

As we know the standard impedance of the speakers, we need to incorporate *impedance transformers.* Adapting the primary to the line and the secondary to the speaker allows the multiple connection of elements.

Installing them is very simple. They are parallel connected and so each sound output can be independently regulated and in case of an individual fault the whole system will not be affected.

IMPEDANCE TABLE

Primary *Impedances* table and the power ratio for the 8 watt speaker we have selected.

Chosen power	8 watts. Ratio 1/1	4 watts., Ratio 1/2	2 watts. Ratio 1/4	1 watts. Ratio 1/8
100 V line voltage.	1.250	2.500	5.000	10.000
50 V line voltage.	312,5	625	1.250	2.500

IMPEDANCE TABLE

It is useful to know when the amplifier is giving optimal performance, through impedance, if we know the power that the amplifier will be able to provide when it is connected to the line output.

P= maximum amplifier power output.
V= output line voltage..
Z= optimal line value.

$$Z = \frac{V^2}{P} = \frac{100\ V^2}{60W} = 167\ Ohms$$

As we know the advantages inherent in 'constant voltage' installations for connections with multiple speakers, we must not ignore the section of our conductor. We have already mentioned that large sections are unnecessary, but we must adhere to some basic rules. In the following table, the minimum conductor sections that we must use for determined power values and distances are shown.

T= 100 volts.

	25 m	75 m	150 m	250 m	350 m
10 W	0,75 mm²	0,75 mm²	0,75 mm²	0,75 mm²	0,75 mm²
30 W	0,75 mm²	0,75 mm²	0,75 mm²	0,75 mm²	0,75 mm²
50 W	0,75 mm²	0,75 mm²	0,75 mm²	0,75 mm²	0,75 mm²
100 W	0,75 mm²	0,75 mm²	0,75 mm²	1,50 mm²	1,50 mm²
200 W	0,75 mm²	0,75 mm²	1,50 mm²	2,50 mm²	2,50 mm²

Power in W for the transformer. Bifilar section in mm².

CHOOSING THE NUMBER OF SPEAKERS

We can determine the number of speakers that we need to install to ensure optimal coverage.

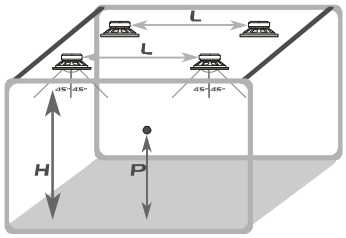
We will determine the quality *Levels* of the system that we will use depending on the demands of the installation.

In this example we will use *Level III* which is the level used in systems for a high level of sound quality. These systems must guarantee a uniform distribution of sound level for frequencies higher than 5KHz and a dispersion of 90º.

We will consider a place with a *Noisy level,* like an office, a shop or any other public establishment with a noise range of 65 to 80 dB.

As value P, we will take a reference listening height of 1.70m. The speakers we will use are our CS6 range. They have a good bandpass, two channels with 90º dispersion all the requirements we need to ensure success.

Our fictitious place is 100m².



$$N = \frac{S_L}{S} = \frac{100\ m^2}{6} = 16.6\ speakers$$

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CHOOSING THE NUMBER OF SPEAKERS

Where:

H height in metres of the place.
L distance between the speakers in metres (see table).
S area covered by speaker (see table).
P average reception measurement of 1.70 metres.
SL SL in square metres, area in which sound is to be produced.

	L (metres)	90° S in metres²
HEIGHT 2,5 m	2,50	6,00
OF 3,0 m	3,50	12,00
PLACE 3,5 m	5,00	25,00
METRES 4,0 m	6,00	42,00

INSTALLATION

Safety Precautions

The **Ceiling** line of speakers has been designed for ceiling installation and as such must be handled by qualified installers.

Mach Speakers a/s. will not be responsible for misuse caused by using areas that are not stable enough or lack sufficient strength to support the units.

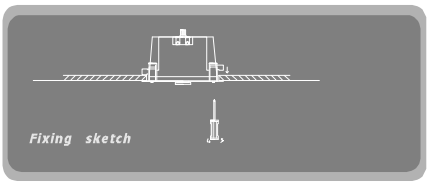
Always keep the power unit disconnected when handling the speaker lines.

When you are doing a connection with voltage lines, you must take into account the choice of the power of the amplifier to adjust the total wattage that our stage will provide.

ABS units must not be cleaned with any solvent-based products as they could be damaged. A soft damp cloth should be used.

Do no expose to direct heat or an excess of humidity.

All material handled by non-authorized personnel will invalidate the manufacturer's guarantee.



Fixing sketch

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INSTALLATION

Description

The CS series consists of three models that vary in size and power. Each unit has a power regulator located in the base.

This regulator switch has a setting that allows us to us work with low impedance. This is the option we should select when we are working with conventional amplifiers. The number of speakers per channel must be taken into account to avoid working with an impedance level that the amplifier cannot support as this could damage the amplifier.

The IN WALL series is composed of one model. It has a regulator switch with the same characteristics as the previous series and also has a switch that allows us to choose different line voltages. This remains inactive when we are working with low impedance.

The connectors are push terminals in red and black with a large input diameter to allow for sufficient conductor sections.

To remove the protective grill use the "hook" that comes with each unit to pull it towards you, taking care not to push the tool in too far as you could damage the speaker membrane. Once removed you will find the four screws that secure the fasteners.

It is important to make sure that we choose the right place to install the speakers. There should be no previous installation present such as water pipes, electric cables etc., as these could be damaged and cause serious problems.

Once we have installed the wire we can mount the speakers. In the following table we will find the fretwork measurements for the different models.

CS 5	185 mm	1.5 Kg
CS 6	210 mm	1.9 Kg
CS 8	250 mm	2.8 Kg
MIW 66	188 x 271 mm	2.6 Kg

CONNECTION

Below, the different ways of connecting the units are clearly shown.

Depending on the mounting you may have to adjust the amplifier so that the output is the correct one. The sum of the power of the speakers must be the same as or less than the total power of the amplifier.

An example of a voltage line installation:

For 12 speakers connected on the 15 watt setting we will need a 180 W RMS amplifier (12 × 15 = 180).

The same amplifier will be still be optimal with the following installation:

2	speakers connected at	30	w	-	60
4	.....	15	w	-	60
6	.....	8	w	-	48
2	.....	6	w	-	12
					180 watt

Parallel installation is recommended for charges of 8 ohms in the speaker and 4 ohms in the amplifier terminals. Series-parallel installations for the same impedances and connection for 100 volt lines.

Diagram A

Speaker system connected in parallel. The impedance per unit is 8 ohms. In the amplifier terminals we will then have 4 ohmsper channel..

Diagram B

Multiple speaker connection maintaining 4 ohms in the amplifierterminals. Speakers with an impedance of 8 ohms perunit and connected in series-parallel. This allows the installation of a considerable number of speakers using a low impedance output amplifier,8/4ohm.

Whe neverwehave4ohms in the phaseterminals, we should consult the phase manual in order to be sure of the charge possibility at this impedance.

Diagram C

Voltage line connection. This typeallowsthemultiple installation of speakers and there canbe considerable distances between the speakers and the source.

If there is a fault inone of thespeakers the rest of the system will not be affected.

We have to take into account the quantity of the speakers and the power output of the amplifier.

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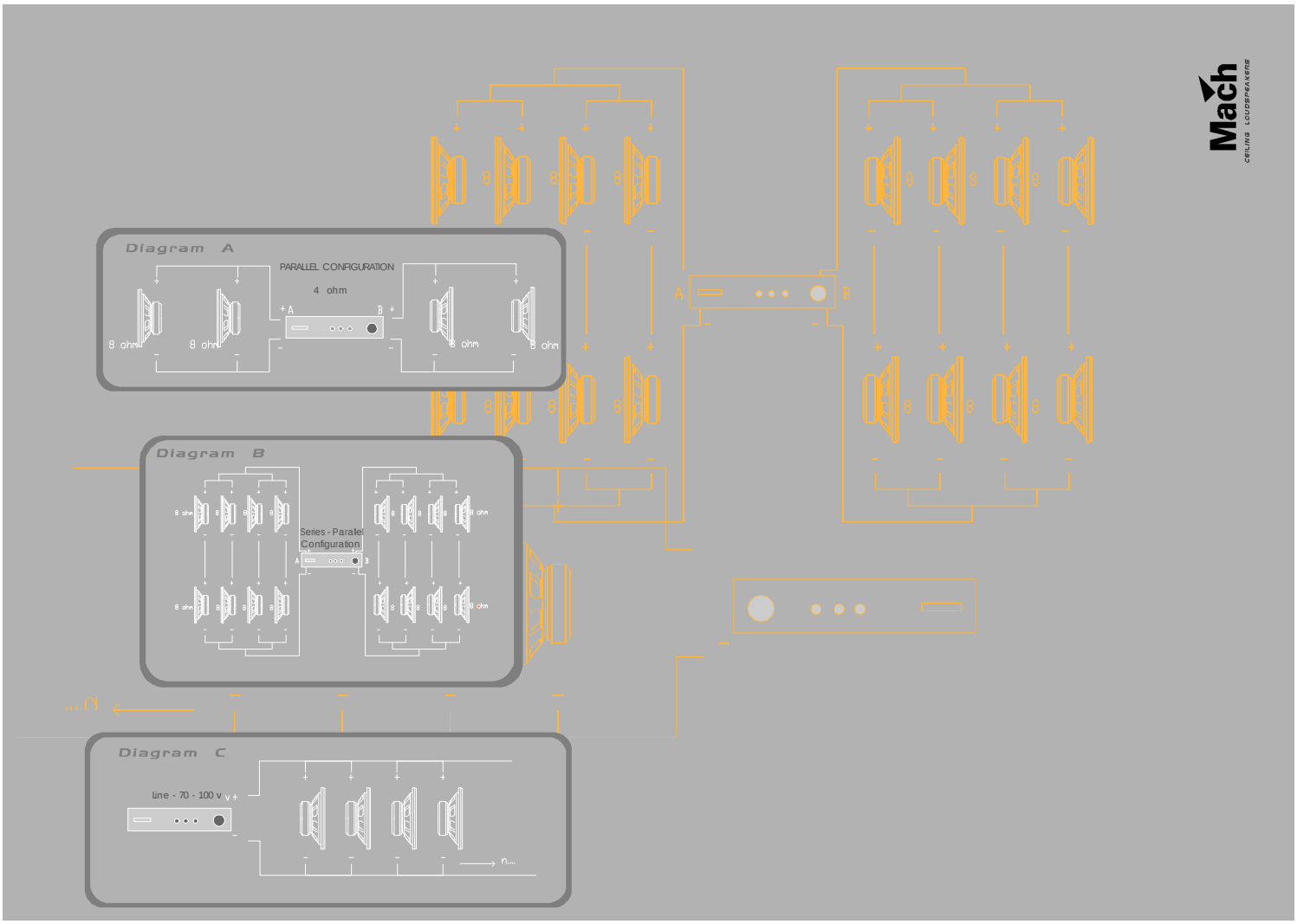
Diagram A
PARALLEL CONFIGURATION
4 ohm
8 ohm
8 ohm
8 ohm
8 ohm
Diagram B
Series - Parallel
Configuration
Diagram C
line - 70 - 100 v