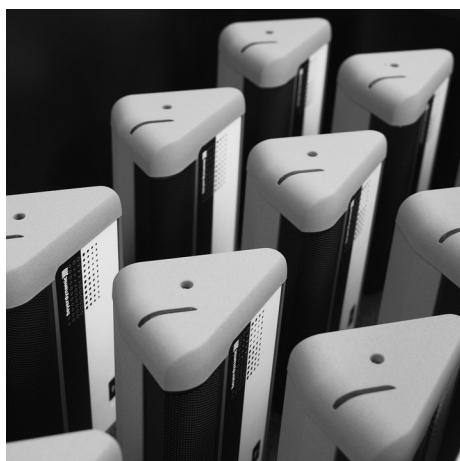


INTRODUCTION



Since 1924, beyerdynamic has dedicated itself to the research, development and marketing of new technologies in audio. Our philosophy is to develop and manufacture first-rate audio products. Then as now, using cutting-edge technology and maintaining a high standard of quality are of primary importance.

Throughout the world, beyerdynamic products are used for improved communication. Our technology is suitable for conventions and conferences of every type and size. beyerdynamic conference systems have become indispensable at functions and conferences held in hotels, executive boardrooms, banks or council chambers. They are easy to set up and operate and are ready for use at short notice anytime and anywhere.



This "Revoluto Design Guide" is a resource to help you plan the use of products with beyerdynamic Revoluto technology. Like any microphone, Revoluto also has acoustic properties that need to be considered when planning microphone set-up and sound reinforcement.

In addition to information about the Revoluto technology and how it works, you will also find tips for correctly using Revoluto with respect to acoustics, based on practical examples.



Do you have any other questions or suggestions for the "Revoluto Design Guide" ?

The beyerdynamic Conference Team is here to help.

Phone: +49 (0) 71 31 / 6 17 - 4 00

E-mail: conference@beyerdynamic.de

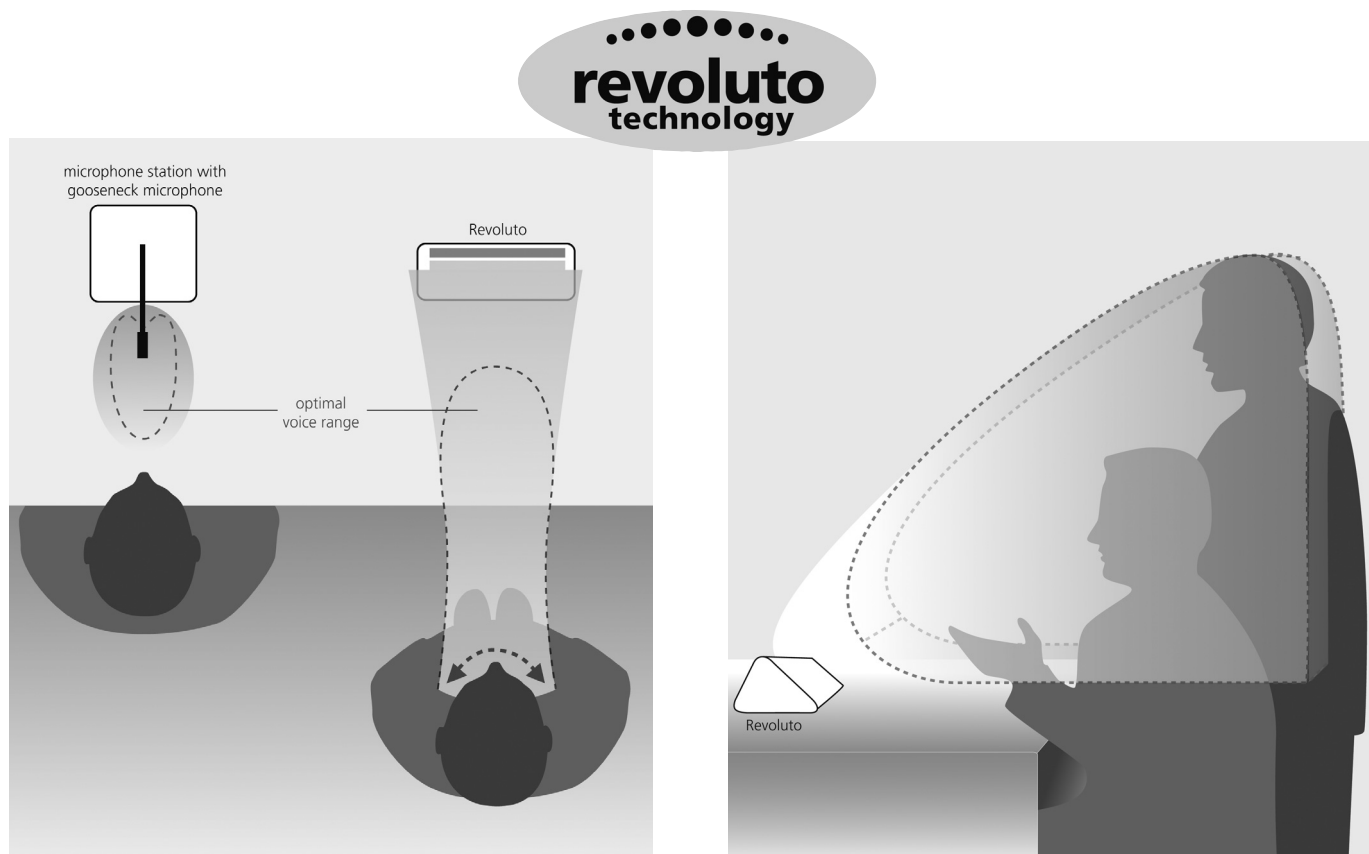
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1. Revoluto – the new freedom of speech

Company founder and audio pioneer, Eugen Beyer, significantly contributed to the invention of the microphone. Since these early days, beyerdynamic, with its innovative technology, has been at the forefront of the audio industry. Today, the company still develops and produces top-of-the-line microphones made in Germany. In 2006, beyerdynamic presented its patented Revoluto technology, marking yet another milestone in the evolution of the microphone.

Comparable to a loudspeaker array, Revoluto technology intelligently combines a series of microphone capsules electronically and mechanically to form a microphone array. The result is the microphone's revolutionary corridor characteristic.



The Revoluto principle in pictures: an optimum pick-up area, whether sitting or standing, thanks to patented Revoluto technology

Revoluto Design Guide

Revoluto – the new freedom of speech

Revoluto technology offers you unique options for microphone set-up, giving the speaker undreamt-of freedom of movement.

Due to the very characteristic that sets it apart from conventional microphones, it is necessary to consider certain physical limitations when designing a system using Revoluto technology.

This Revoluto Design Guide explains the basic technology, the physical laws upon which it is based and the resulting guidelines for optimum system integration.



With Revoluto the speaker can lean backwards ...



... speak to the side ...



... or even stand up



More flexibility – with Revoluto wireless

Revoluto technology – simply an advantage

The corridor characteristic allows...

- Better visibility for and of the speaker
- More workspace - the microphone / microphone unit is in the background
- More freedom of movement – sitting or standing, as the speaker wishes
- One microphone fits all – no complicated individual settings
- Constantly good and even speech quality

Revoluto is worth the price

Revoluto has won two AV industry technology awards: the "Technology InAVation Award 2007" from the European AV magazine "InAVate" and the "Installation Product Award 2007" from the InfoComm Association and the US magazine "SCN".



Revoluto – the new freedom of speech



2. Products using Revoluto technology

A number of opportunities exist for integrating advanced Revoluto technology into various products. The Revoluto design allows totally new combinations, such as the fold-away microphone unit. In the future, expect to see more of such Revoluto technology products being developed.

2.1 Microphone units for the MCS Digital cable-based conference system

The fully digital, cable-based MCS Digital conference system provides the basis for running conferences and meetings efficiently. The open system architecture affords a wide range of applications – from the integration of basic systems for discussions to highly complex installations in parliament buildings.

The MCS-D 3121/3123/3171/3173 microphone units are available with a connector on the rear or at the bottom. For precise technical product information, please refer to the data sheets and brochures for the individual products. Visit us online at www.beyerdynamic.de/revoluto for more information.

2.1.1 Desktop microphone units

MCS-D 3121

Delegate microphone unit with microphone button . . Order # 484.318



MCS-D 3123

Chairman microphone unit with microphone, priority and clear buttons Order # 483.079



MCS-D 3171

Delegate microphone unit with microphone button, language selector with volume control, display and function keys for voting. Order # 484.695



MCS-D 3173

Chairman microphone unit with microphone, priority and clear buttons, language selector with volume control, display and function keys for voting Order # 483.087



2.1.2 Built-in microphone units with connection interface (fold-away)

In addition to the classic conference system functions, this built-in microphone unit has interfaces that allow a notebook to be connected to a local network and/or a VGA video signal to be fed in.

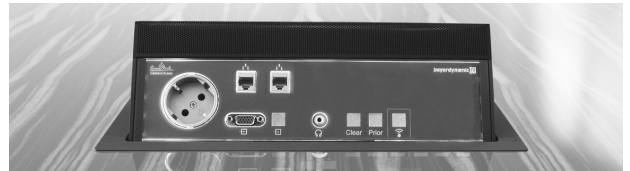
MCS-D 3911

Delegate built-in microphone unit with microphone button Order # 486.728



MCS-D 3913

Chairman built-in microphone unit with microphone, priority and clear buttons Order # 486.736



MCS-D 3971

Delegate built-in microphone unit with microphone button, language selector with volume control, display and function keys for voting. Order # 486.744



MCS-D 3973

Chairman built-in microphone unit with microphone, priority and clear buttons, language selector with volume control, display and function keys for voting Order # 486.752



2.2 Microphone units for the wireless MCW Digital 50 conference system

The MCW Digital wireless conference system allows mobile and flexible microphone unit placement. The microphone units can be set up and taken down quickly and easily. Stored in a case used for charging and transport, they are ready for use at any time. With Revoluto wireless, the advantages of a wireless system and Revoluto technology are melded.

MCW-D 531

Delegate microphone unit with microphone button . . . Order # 486.426



MCS-D 533

Chairman microphone unit with microphone, priority and clear buttons Order # 486.434

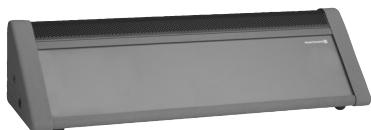


2.3 Revoluto microphone units and desktop microphone units

If conference system features are not needed, the Revoluto can be used purely as a microphone unit.

MPR 110

Desktop microphone Order # 486.671



MPR 111

Desktop microphone unit with programmable microphone button and interfaces for external control Order # 486.698



MPR 911

Built-in microphone unit connector panel - Design by Rosenthal Einrichtung with programmable microphone button and connections for external (logical) control Order # 486.760



3. Revoluto technology

Vive la revolution!

Only since the French Revolution in the 18th century do we understand revolution to mean a "violent political overthrow". After the late Latin term "revolutio" had first been used in the 15th century to denote the rotation of the planets, the word Revolution came to be used to refer generally to fundamental and sudden change.

In conference technology, too, we have already experienced many a revolutionary invention. In the past few years, these innovations have mainly been in the fields of signal processing and transmission, one example being fully digital conference systems, such as the MCW-D 50 or MCS-D 200. Audio signals and control commands are transmitted in ones and zeros. Bidirectional multi-channel capability is just one of the many benefits.

The engineers at beyerdynamic, however, have also uncovered the potential for innovation in acoustics, as impressively demonstrated by the microphones and microphone units using the patented Revoluto technology.

In the days before the revolution

A familiar sight, either from our own experience or from the press and TV: at any conference you will see a true gaggle of gooseneck microphones on the conference tables, obstructing not only the view of the panel but also that of the interested audience. Until now, we have simply accepted these "black lines" in front of the faces of the conference speakers. "We've no other choice!" we thought. But we do! And what a choice!



A gaggle of gooseneck mics – a thing of the past...

The principle of microphone set-up

Gooseneck microphones and pencil microphones (with folding, rotating, pull-out or any other design) have directional capsules with practically only a cardioid characteristic. These units are used in the near-field of the sound source, not to be confused with the direct near-field of the capsule. To attain a sufficient volume transmission using loudspeakers in the same room, you need a high ratio of direct noise (from the person speaking) to indirect sound (from the transmitting loudspeakers). This is the only way to largely prevent acoustic feedback. When there is feedback, one hears the familiar and annoying high-pitched whistling sound.

In a typical conference microphone unit set-up, the transmitting loudspeakers are present in all microphone units, something known as a decentralised sound distribution. Unlike reproduction using ceiling loudspeakers or some other centrally positioned loudspeakers, this approach has the great advantage that every participant is sitting within the reverberation radius of the loudspeaker placed closest to him or her. The reverberation radius denotes the distance from the sound source (in this case the loudspeaker) at which the portion of sound directly received is matched to the portion of sound received via reverberation. This ratio is of key significance for understanding speech.

Some background on audio physics

In physics, this means increasing the distance to the sound source. The inverse distance law $1/r$ describes how the sound pressure level decreases proportionally with an increased distance.

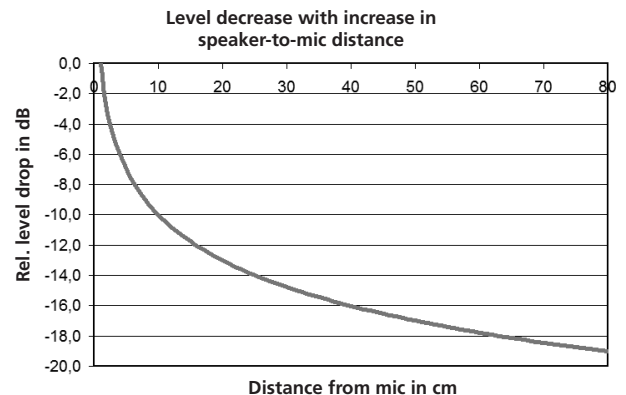


Diagram showing the sound pressure level decrease with increased speaker-to-mic distance

Provided it were possible to increase the distance, the transmission volume would change relatively little. In the graph above, the operating point on the $1/r$ curve is where the course is nearly horizontal. Maintaining a constant volume when various people are speaking is optimum not just for sound engineers and interpreters, but also the audience.

However, if we were to simply increase the distance, meaning installing the capsule not in the gooseneck but directly in the microphone unit, the ratio of direct-to-indirect sound would worsen quickly. The transmission volume would have to be adapted by increasing the gain. The result: Acoustic feedback via the ceiling loudspeakers in the room.

The typical speaker-to-mic distance for a conference gooseneck microphone is 20 cm. Increasing the distance to 80 cm (with the mic ideally positioned at the far edge of the table) is greater than triple the distance, meaning a sound level pressure loss of more than 10 dB. Conventional conference equipment cannot compensate for such a sound level pressure loss.

Forewarned is forearmed?

Approaches to solving the problem to date...

Shotgun microphones do have a bundling effect, but also entails the disadvantage that the directional pattern becomes very narrow, so whenever the speaker moves sideways or up or down there is a dramatic drop in sound pressure levels. Even in designs with short bodies, the dimensions for such microphones are too large on the plane of the sound source.

After the industry realised that the ratio of direct-to-indirect noise is the critical criterion in conference settings, designs were developed that have shifted this ratio with an increased cancellation of the indirect sound. Take the cardioid plane microphone for example where a vertical line of microphones, similar to the familiar lines of loudspeakers, vertically narrows the directional pattern.

One other example is "beam forming", using microphone arrays. Today, beam forming is more feasible for special applications, but not for conference settings.

With its vertical cancellation, the cardioid plane microphone is intended to cut out the sound from ceiling loudspeakers or sound from the room's loudspeakers reflecting off of ceilings and the floor. The horizontal directional pattern should initially be as wide as possible to provide the person speaking with a wider range of movement. However, this method is not suitable when many conference microphone units are set up at the same table height, because the horizontal pattern is far too wide and the loudspeaker installed in the neighboring microphone unit is picked up. Moreover, the necessary geometric set-up and required vertical arrangement of many units is no less distracting than gooseneck or pencil microphones.

Beam-forming methods using an array on one plane are used mostly for flat sound waves, i.e. from sources infinitely far away. This is not the case in conference applications. Furthermore, such a set-up is also much too large and awkward.

Optimised problem solving

To permit the microphone to be much further away from the source, the following conditions have to be met:

- The energy received from unwanted sources of sound (e.g., a neighboring mic unit, indirect sound) may increase only slightly
- The direct sound energy received from the sound source must increase greatly
- The loop gain must not increase

With a greater speaker-to-mic distance, the microphone or the sound reception equipment must compensate for the loss in sound pressure levels (N.B. the $1/r$ law with an increase in distance) without any increase in the sound portions received from other directions. At first glance, this seems to be contradictory and not feasible.

The dilemma can be solved only by taking energy into consideration, with the goal of increasing the energy received from the useful sound source. By doing so, the ratio with respect to interfering sound is automatically improved. Laplace's law describes how energy penetrates surfaces. The larger the surface area, the greater the usable energy. From physics, we know that the sphere is the geometric shape with largest surface area in relative terms. Therefore, it would be ideal to have a "spherical receiver" around the person speaking. The person speaking would have to remain in sort of a bubble, the surface of which was

covered with sound receivers. Unfortunately, this does not work in practice, of course. To date, the exact opposite has been the case. A single microphone picks up only a small portion of the usable sound energy produced by the person speaking. The greater portion is dispersed, unused, throughout the room.

As is so often true, the Golden Mean is the correct approach. Neither a "spherical receiver" nor a single microphone offers a (practicable) optimal solution, but a compromise. Increasing the number of transducers or their surface area is already the basic prerequisite for sufficiently converting the sound source energy into an electric signal. Since the ratio of useful energy (from the desired direction) to unwanted energy (from other directions) would otherwise worsen, all transducers or microphone capsules would have to be focused on the person speaking. As with a directional lobe, all transducers aimed past the sound source increase the portion of unwanted sound energy.

The Revoluto microphone array, with its patented arrangement of numerous capsules on the surface of a virtual sphere, uses this principle, allowing a large speech corridor instead of a small pick-up area.

However, some tricks in signal processing are still needed to create a pick-up zone that has a convenient width and does not rely on frequency. The phase relations among the various transducers also have to be taken into account.

The pick-up zone is electronically widened so that the person speaking can lean back in his or her chair or over to one side without there being any sound distortions or drops in sound pressure levels. The person sitting next to them, however, is almost entirely cut out. Ideal for conference applications.

More microphone capsules - higher sound pressure levels

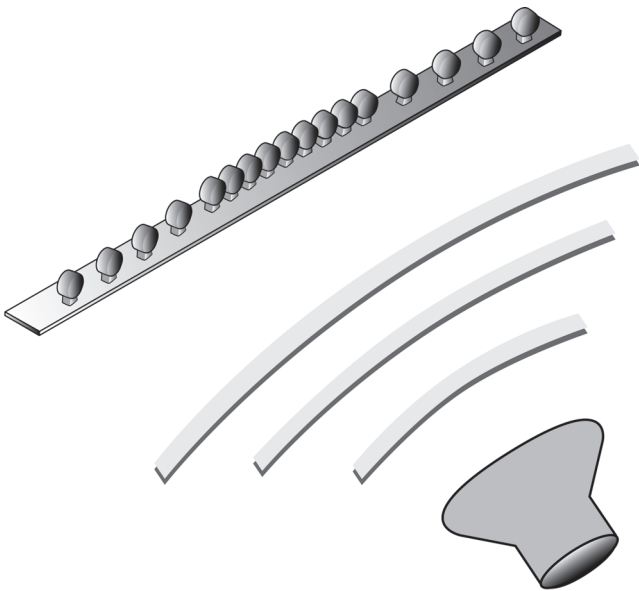
Sounds simple, but it really is true.

All capsules provide the same signal and are subject to the same feedback conditions. If these signals are correctly added together with respect to their phase, however, the output value of the useful signal increases by 6 dB whenever the microphone capsules are doubled. As the phases of all capsules are different from one another and correlate only slightly, the noise increases only by 3 dB when the number of transducers is doubled. Each time the capsules are doubled, the signal-to-noise (s/n) ratio increases by 3 dB.

s/n ratio based on the number of transducers

2 capsules	->	3dB
4 capsules	->	6dB
8 capsules	->	9dB
16 capsules	->	12dB

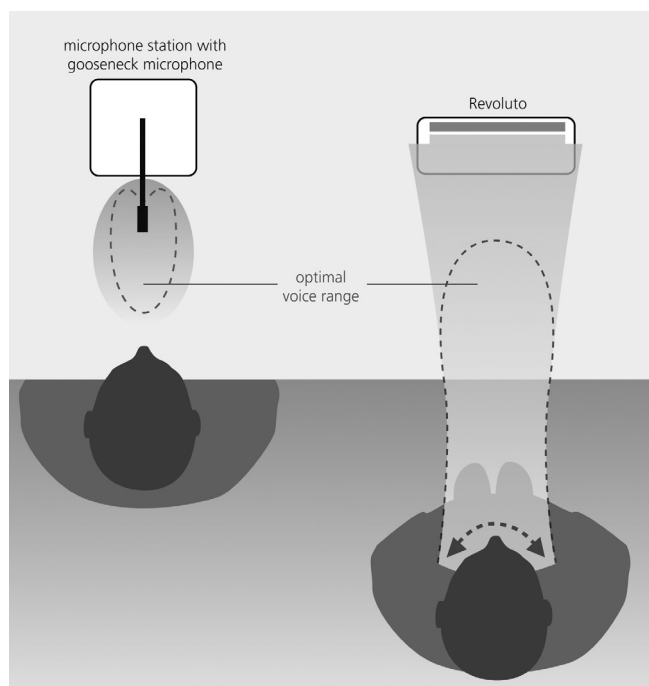
The use of 32 or more capsules does not present any sort of an electrical problem, but beyerdynamic has been able to attain optimal acoustic results using the minimum of space with 17 capsules.



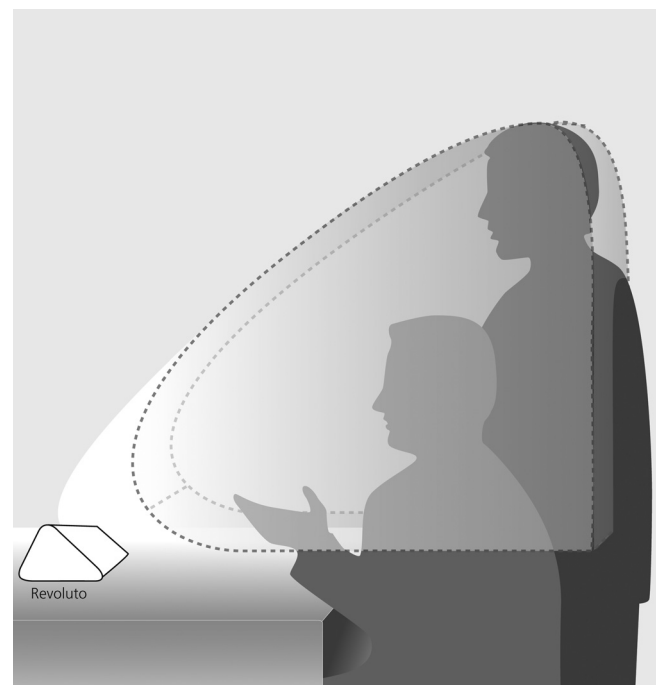
As far as canceling unwanted sound portions, i.e. feedback suppression, is concerned, this approach also has benefits. In general, reflected sound portions have a lower correlation than direct sound, which applies not only for noise but also for the useful signal. This in turn provides more protection against feedback. Maximum cancellation on the horizontal plane is not at 180°, as with the cardioid capsules used in individual microphones, but at 90° - the exact equivalent of the position of the directly neighboring microphone units.

Vive la revolution!

This is one of the reasons why the Revoluto microphone units have such excellent protection from feedback in conference applications. Compared to other set-ups with conventional individual microphones, the level of protection is at least 4 dB, and typically even 6 dB greater – even with person-to-mic distances of up to 80 cm. Moreover, the microphone unit can be placed on the opposite side of the table, leaving enough space for documents. In spite of the large person-to-mic distance, optimal speech intelligibility is attained, as are very good useful sound pressure levels (gain before feedback).



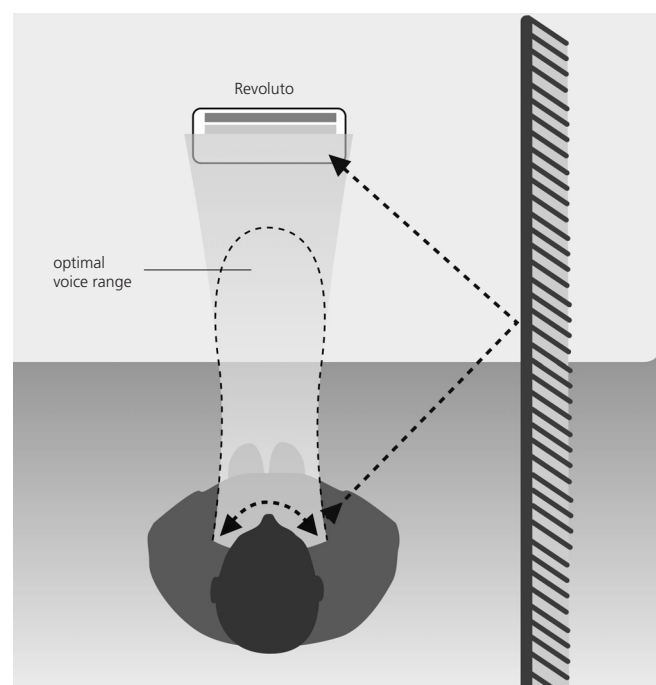
Yet another aspect of physics makes Revoluto technology truly suitable for practical applications: with a speaker-to-mic distance ranging from 30 cm to 80 cm, the volume varies only by a max. of 3 dB. The active conference participants can lean forward, lean back to relax or even stand up. Optimal intelligibility, constant voice tone quality and a constant and very good sound pressure level – revolutionary!



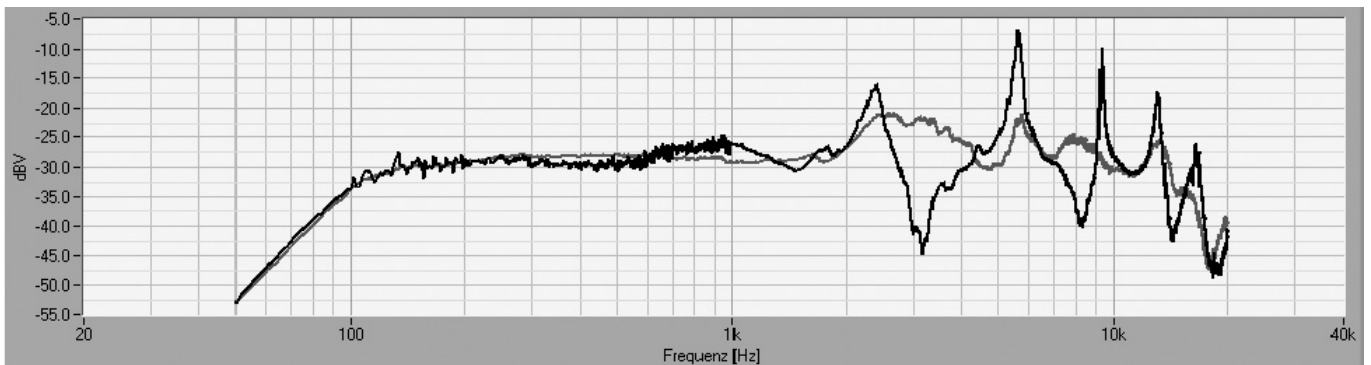
Nobody can do magic

As with every new piece of innovative technology, there are some limitations that come along with the outstanding advantages. In the case of Revoluto, it depends on the application. Microphone units using Revoluto technology lack the intelligence to determine whether the signal is being picked up from the person speaking or from sound waves bouncing off a wall behind that person. In the case of the latter, there are unwanted reflections, which could lead to worse intelligibility, especially in rooms with echoes. In addition, attaining sufficient volume in a conference room is possible only with difficulties due to the increased tendency towards feedback (see gain before feedback).

Seldom, there may be a comb filter effect, in spite of filters, with extremely reflective table surfaces. The sound waves reach the microphone capsule both directly and indirectly via the reflection from the table's surface. Both sound waves overlap and can lead to cancellation at different frequencies



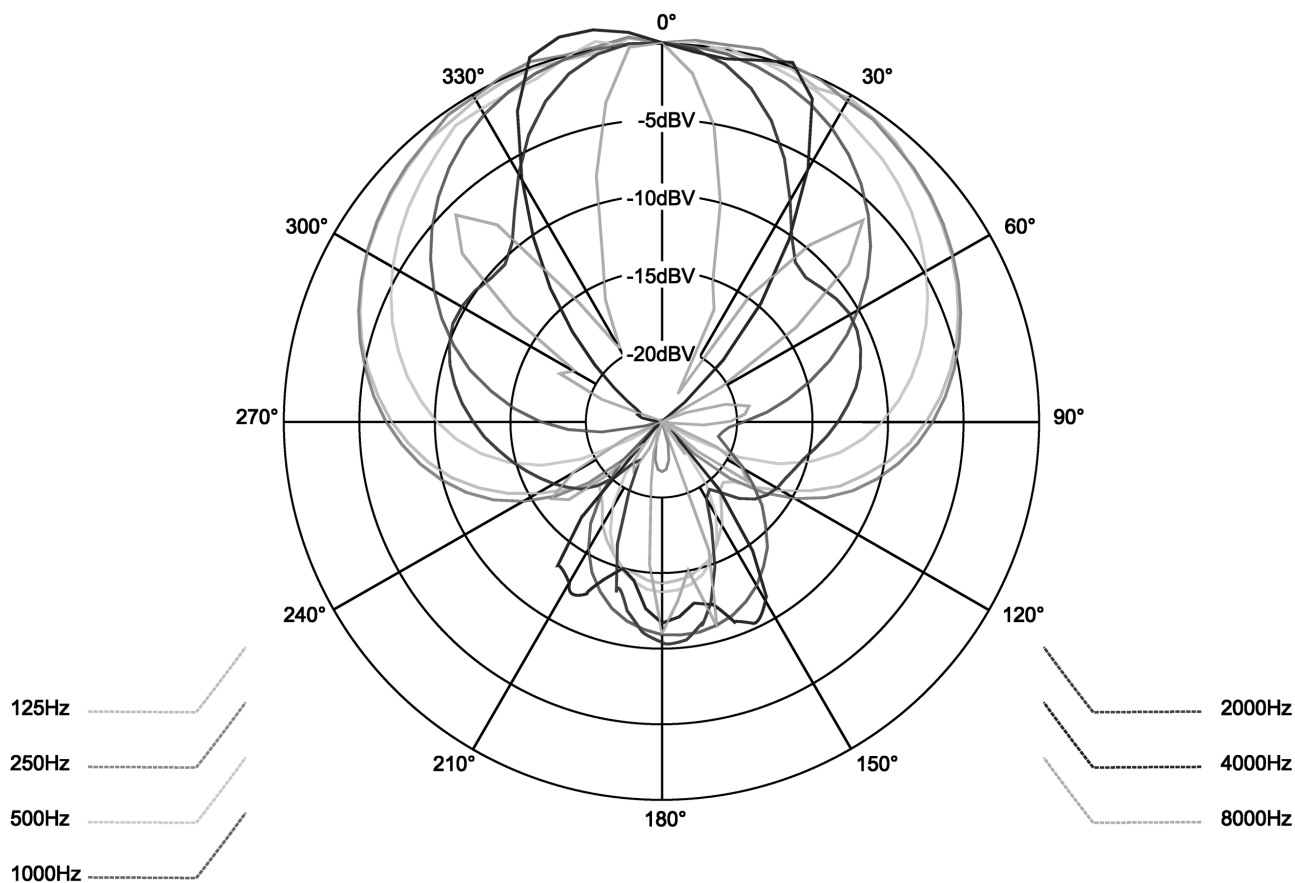
In the figure, you can see the frequency response without a table (microphone unit in open space, light grey) and on a table (black). The comb filter effect due to the reverberation coming from the desktop is clearly recognisable. With an increased portion of reflected sound waves, this effect is amplified. To avoid this type of reflection entirely, the table surface would ideally have to be made of a material that fully absorbs sound, such as a thick-pile carpet.



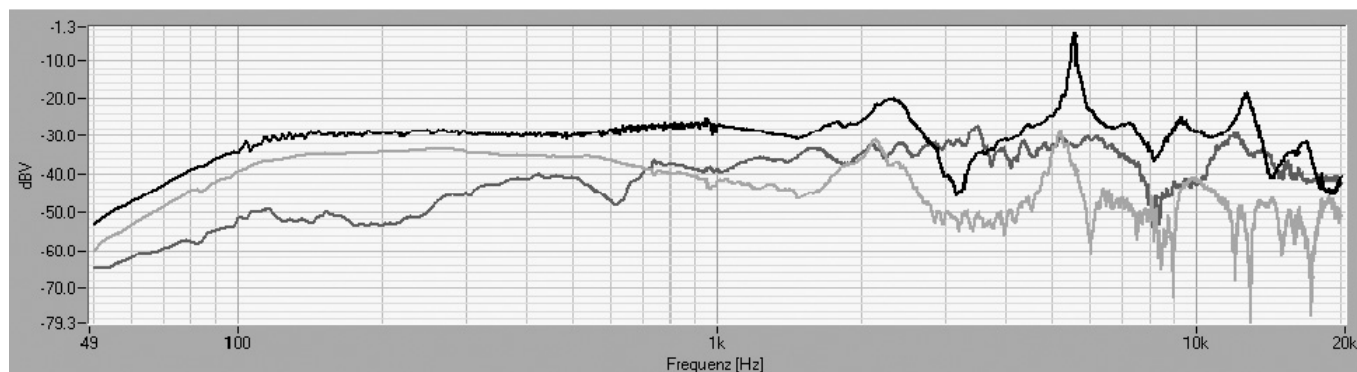
Frequency response with (black) and without (light grey) table top

Revoluto on air

To describe the directional characteristic of the microphone unit, we need a polar diagram. This diagram illustrates the microphone sensitivity at various angles of sound incidence on the horizontal plane.



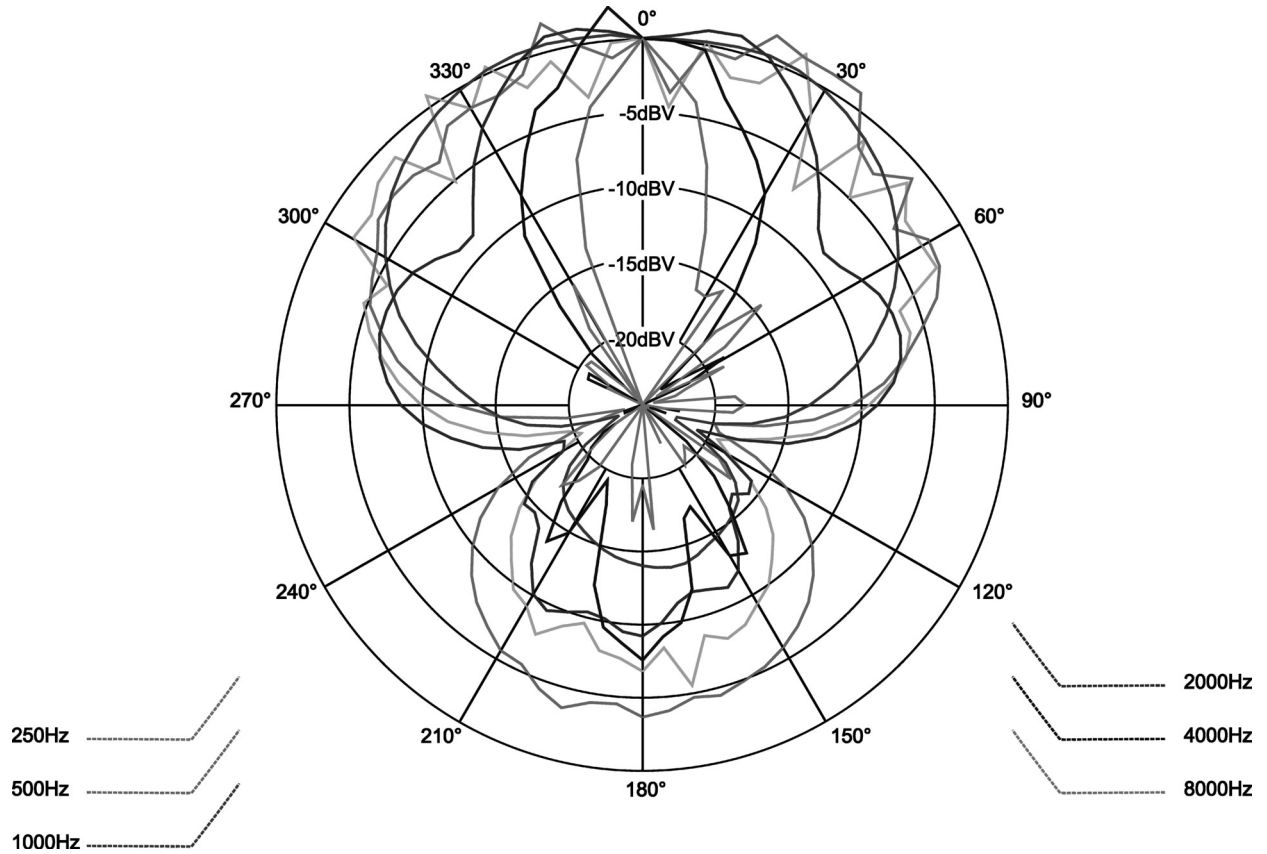
Polar diagram at a distance of approx. 60 cm from the sound source; microphone unit is placed in the centre of a table surface, approx. 50 cm x 60 cm.



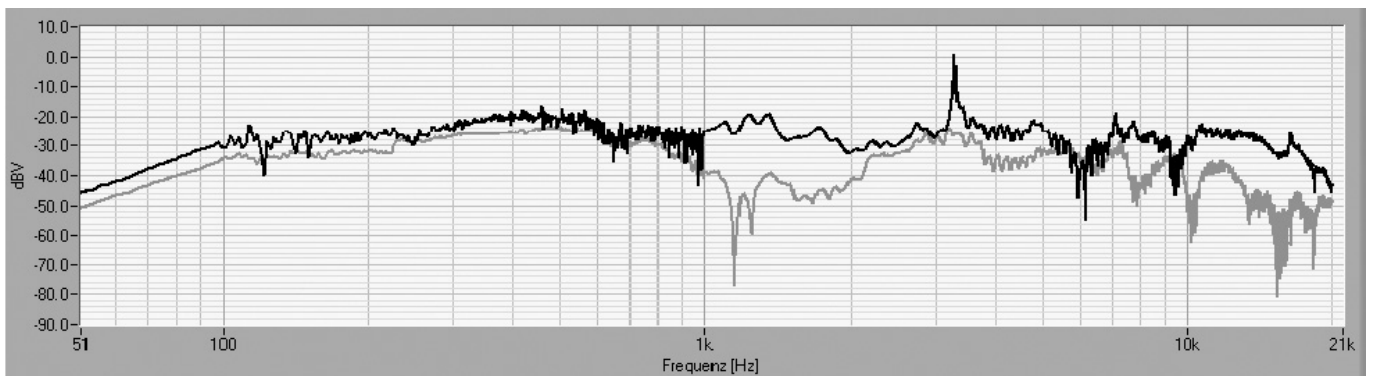
Frequency response: 0 degrees (black), 90 degrees (dark grey) and 180 degrees (light grey)

The polar diagram shows how the directional effect shifts over to the corridor effect only at mid-range frequencies. The explanation in terms of physics: at 300 Hz, wavelengths are greater than one meter. To attain a greater directional effect at these low-range frequencies, the microphone unit would have to be geometrically scaled by the same order of magnitude. The space available in a conference room would hardly permit this.

Interfering surfaces (such as monitor screens) directly behind or above Revoluto microphone units are to be avoided in particular. The corridor effect is severely limited under such conditions. In the worst case, there is a cardioid characteristic apparent on the microphone's polar diagram. A minimum distance of 30 cm is to be maintained for all microphone capsules in all directions (except for downwards).



Effect of a monitor located behind the microphone unit; the microphone characteristic is absolutely "distorted"



Frequency response: 0 degrees (black), 180 degrees (gray); there is hardly any rear attenuation.

And finally ...

Revolutio technology from beyerdynamic is truly revolutionary. For most installations and applications it offers a pronounced improvement in speech quality, greater freedom of movement for conference participants and significantly improved photo opportunities.

The fact remains, however, that in some applications, especially those with very complex room acoustics, the gooseneck microphone still has its uses.

4. Microphones – as compared to Revoluto technology

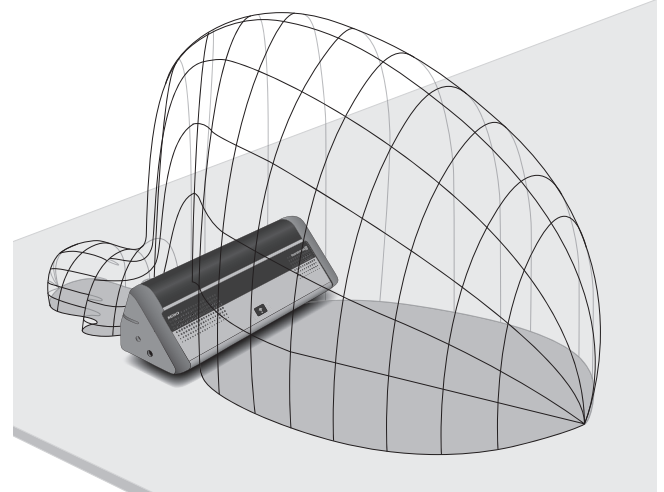
4.1 Gooseneck microphones

Using Revoluto microphones or microphone units has some key advantages over conventional microphone set-up in many applications. Standard microphones, such as the SHM 2xx or SHM 8xx series of beyerdynamic gooseneck microphones, always have a directional characteristic that is rotationally symmetrical. Therefore, the use of these microphones generally implies that not only sound from the side, but also sound from above and below, is cut out. As a result, in practical terms, the person speaking must sit relatively still in front of the well-positioned microphone. Even small movements to the right or left, up or down lead more or less to deterioration in sound reception quality.

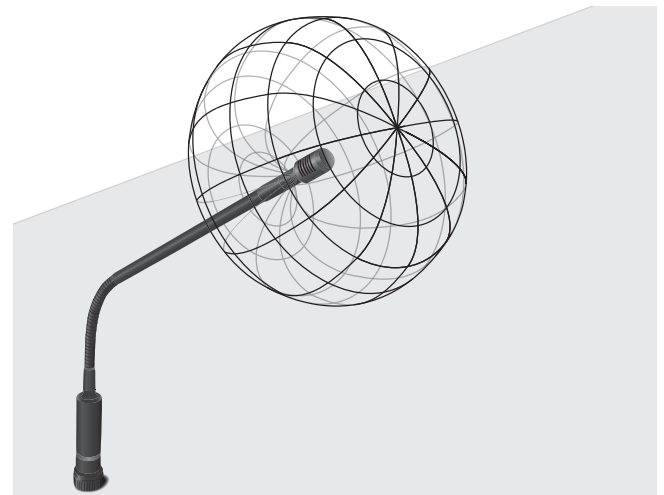
In many countries, is it advisable for the speaker to stand up to speak in public. Acoustically, however, this is not always advisable. When standing, the speaker is usually within the side attenuation range of the microphone. The loss in sound pressure at the beginning of the pick-up chain can no longer be compensated and intelligibility suffers greatly. To date, extended goosenecks with lengths of 500, 600 or even 700 mm have been used to solve the problem – a poor compromise. When a person is seated, these microphones or microphone units can no longer be used.

The corridor characteristic of microphones using Revoluto technology has the potential to eliminate this weakness in sound pick-up technology. Unlike the rotationally symmetrical directional characteristics of microphones with only one transducer, Revoluto technology permits differently optimised characteristics on the horizontal and vertical planes. On the horizontal plane, the microphone has a directional characteristic similar to a lobe. Lateral noise components (e.g., that of immediately neighboring panelists) are cut out sharply. On the vertical plane, the microphone has a semi-cardioid characteristic. This greatly expands the reception angle in the upward direction. Whether the person is tall, short, sitting or standing, leaning back and/or to the side – excellent consistent sound reception is guaranteed without continuous microphone adjustment on a gooseneck. The direct sound portion remains almost the same. In addition, the increased speaker-to-mic distance thus achieved creates a working area on the conference table, while ensuring an unobstructed view for and of the person speaking.

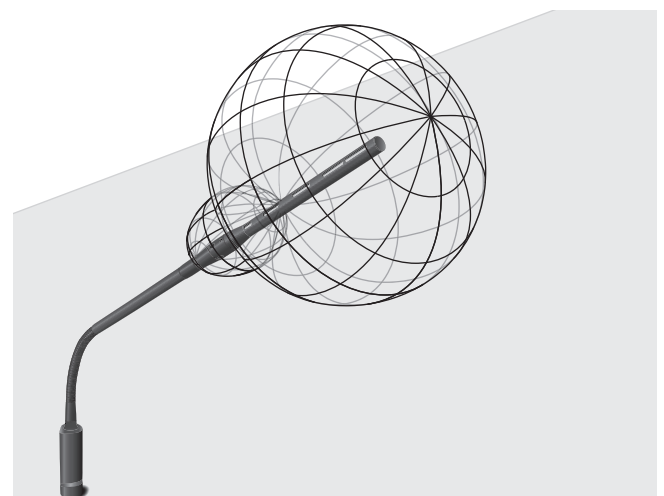
What was once just a dream regarding audio reception is now reality thanks to Revoluto technology – provided that important acoustic limits and predefined installation guidelines are observed during the system design phase.



Directional characteristic of the Revoluto microphone



Directional characteristic for SHM 2xx



Directional characteristic for SHM 8xx

5. Tips for installation

5.1 Microphone and loudspeakers

Figure 1 illustrates the directional characteristic of a microphone unit using Revoluto technology. It clearly shows that lateral sounds are cut out, while the pick-up area is opened upwards. However, it also makes clear that sound coming vertically from above will also be picked up. In many applications this effect is negligible. However, if ceiling loudspeakers are used, the feedback limit can quickly be reached.

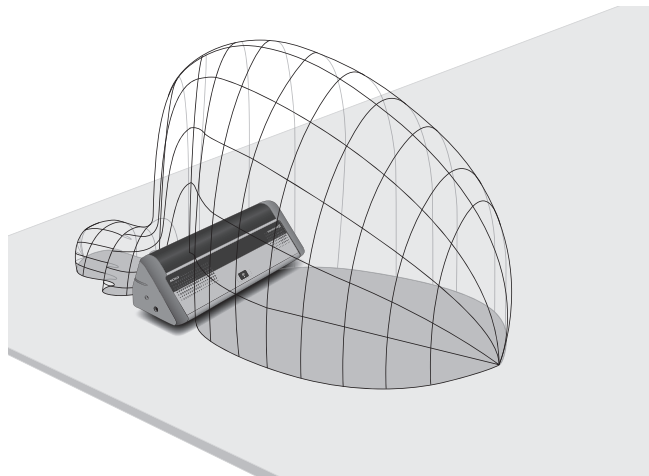


Fig. 1: Directional characteristic of the Revoluto microphone

Loudspeaker selection determines the later quality of sound reinforcement in the conference room. If the ceiling loudspeakers are positioned decentrally in relation to the microphone units, they require an expanded radiation area. Loudspeakers with a 360° radiation characteristic are particularly well-suited for this purpose. The energy is dispersed throughout the room in an even and homogenous fashion. Hard reflection is avoided and the position of the microphone units with respect to the ceiling loudspeakers becomes less important. Any reputable manufacturer will have appropriate loudspeakers in their product line [e.g. NewTec, with the ConoAlto, or ML Audio, with the Novosonar].

Note:

Positioning ceiling loudspeakers directly above a Revoluto microphone is not optimal. If the ceiling loudspeakers are designed to be offset from the microphone units (or vice-versa), the loudspeakers are then already in the side attenuation range of the microphone (see Fig. 2), effectively avoiding any feedback effects.

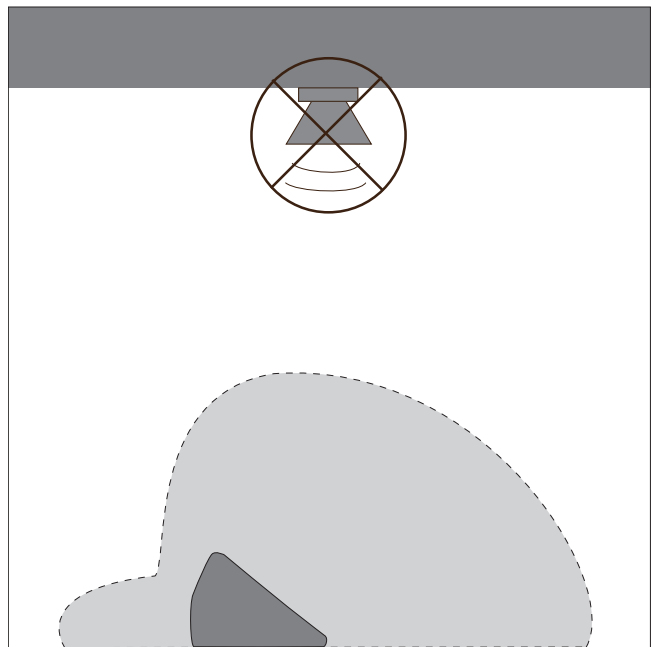


Fig. 2: Effective avoidance of feedback effects

Even with careful space planning, it is not always possible to prevent calculable feedback risks. Room features or architectural restrictions often restrict the positioning freedom needed. An electrical-acoustics approach provides a solution that even allows ceiling loudspeakers to be positioned at the less-than-optimum 90° to the microphones. With this approach, it is imperative that the microphone signal is not run through the ceiling loudspeaker above it. This type of audio routing is referred to as N-1 or mix-minus. Each ceiling loudspeaker is assigned its own, individually mixed signal in which the signal from the microphone located beneath the respective loudspeaker is cut out.

Note:

With ceiling loudspeakers located above the microphones in the following audio system, a mix-minus design is absolutely necessary.

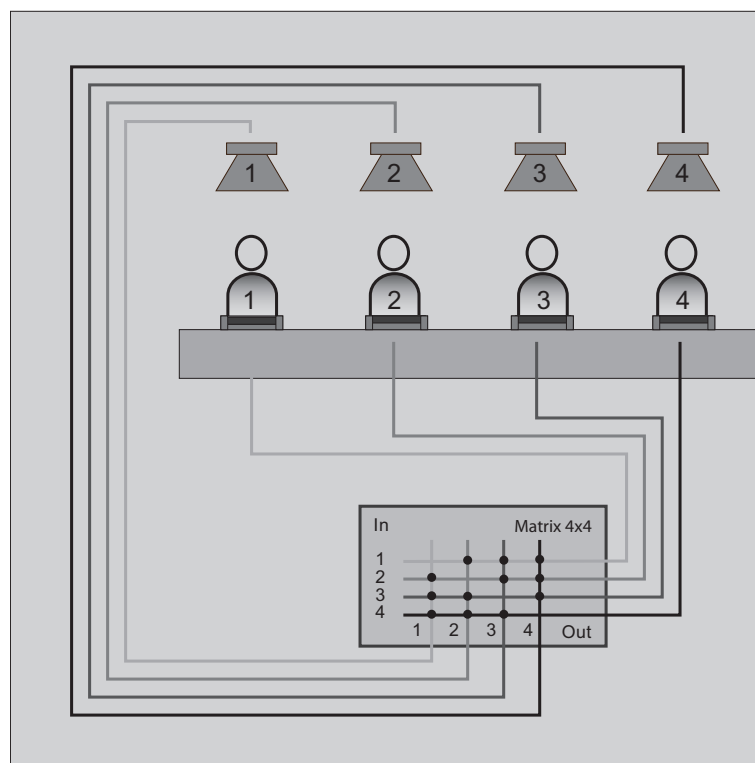
The mix-minus routing is done by selecting one amplifier channel for each ceiling loudspeaker so that signals can be distributed individually. Ideally, the mixer to which the microphones are connected must have a large mixer matrix. For example, with 10 microphones, a 10 x 10 matrix is needed.

This requirement can only be met with great difficulty in analog mixers. Therefore, programmable audio digital signal processing (DSP) systems are much better suited. Biamp Systems (Audia) or BSS (Soundweb) specialise in these matrix mixers. Setting up a 40 x 40 matrix is not particularly difficult. Even power amplifiers can be installed in the AudiaFLEX mainframe from Biamp Systems. Setting up a 12 x 12 matrix without an additional power amplifier with only 2HU is feasible.

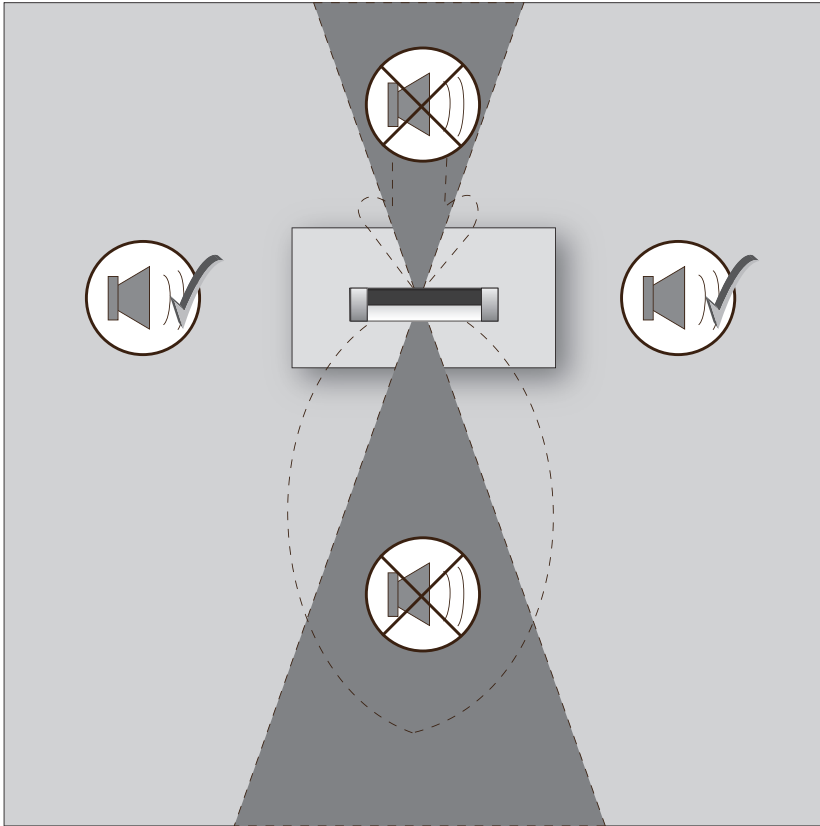
When you consider the Revoluto microphone's 3-D directional characteristic, another important detail becomes apparent. At angles below 180° on the horizontal plane (i.e. behind the microphone), there is a side lobe. Today's technology can only keep this to a minimum. The fact remains that even in this case unwanted sound can be partially picked up.

Note :

Do not position loudspeakers directly behind the microphone units.



The following is a practical example of microphone/loudspeaker positioning.



The Revoluto microphone is on an altar located in the centre of the room. The churchgoers are sitting in a semi-circle in the area in front of the altar. The ideal positioning for the loudspeaker is derived from the directional characteristic. It is not in the direct pick-up area of the microphone (approx. $0^\circ \pm 15^\circ$), not directly above the microphone and not directly behind it either. The ideal position is off to the side, on the wall.

Note:

If possible, always position loudspeakers off to the side of the microphone unit.

In the real-life example above, the church's average reverberation period was 2.2 seconds. Using a Revoluto MPR110 microphone and two appropriately positioned lines of loudspeakers, an STI of >0.55 was achieved throughout the entire audio area.

5.2 Microphone positioning

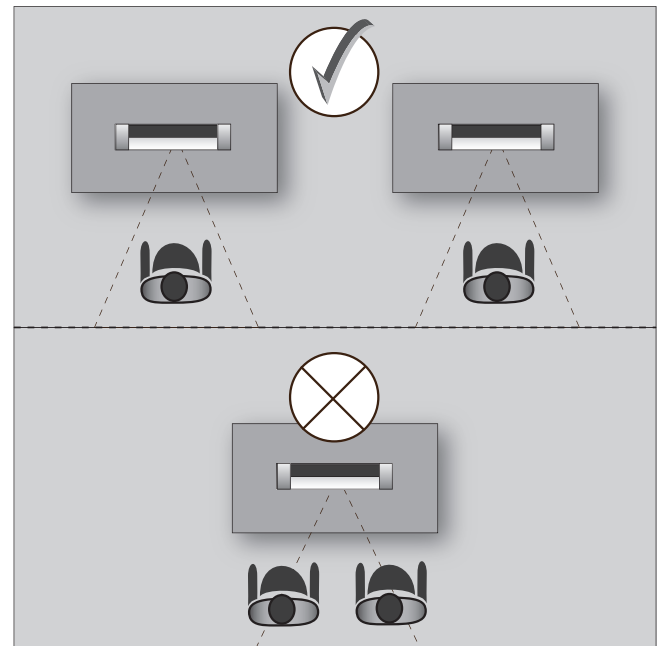
Without knowing more about the corridor characteristic of microphones using Revoluto technology, it would be easy to assume that two speakers could share one microphone unit. For aesthetically-inclined system designers, this is not necessarily the first choice, but, with gooseneck microphones, it is a cost-saving possibility during the installation phase. That is, if you overlook the direct mechanical wear to which the microphone is subject.

The basic idea behind Revoluto technology, which sharply cuts out lateral sounds, contradicts this assumption, however. Microphone sharing would be possible, by turning the microphone unit in the direction of the person speaking, but not practicable.

The adjacent illustration shows two people in front of one microphone unit. Both are seated outside of the optimal pick-up range and intelligibility would be sub-optimum for both.

Note:

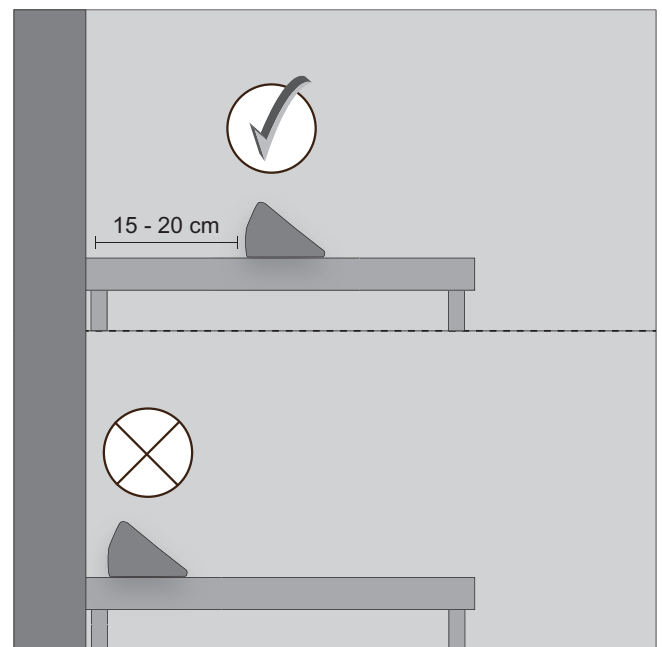
Each speaker should have his or her own microphone.



The microphone units and microphones with Revoluto technology must not directly be placed with their back in front of a wall. The minimum distance to the wall should be 15 to 20 cm. An acoustic shadow due to obstructions, such as books, newspapers or conference papers, compromises performance greatly.

Note:

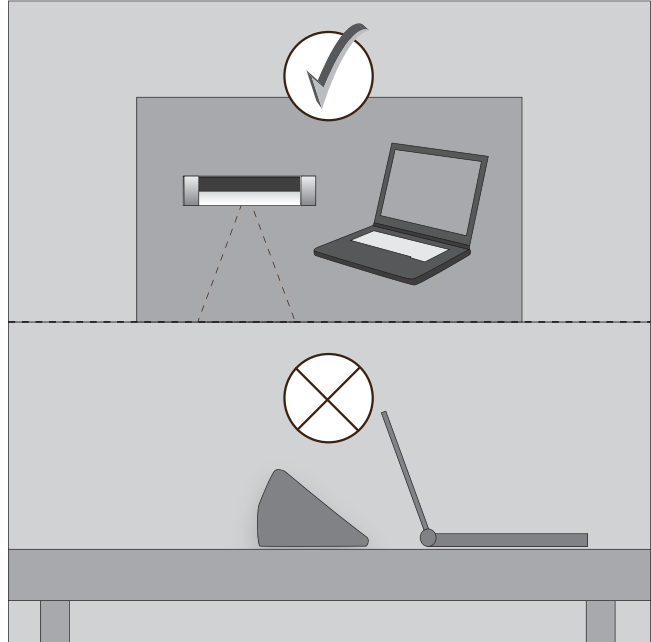
The Revoluto microphone needs room to “breathe”. In terms of acoustics, each of the microphone capsules needs a “clear view” of the person speaking as well as an open space to the rear.



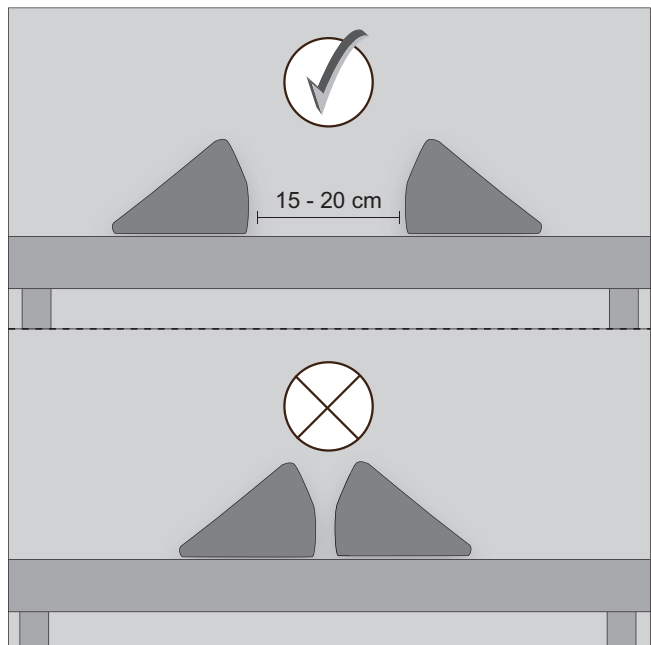
When notebooks are being used, it is also necessary to consider the microphones. Notebooks should always be positioned to the side of the microphones. Otherwise, when opened, the LCD screen would obstruct the sound. This also applies to free-standing monitors. Sufficient distance is the key to the directional effect and good feedback suppression. Moreover, notebooks often have fans at the back. The noise of the fan would then be fully picked up by the the microphone.

Note:

Keep boundary surfaces at a minimum distance of at least 30 cm, and make sure there are no sources of noise interference in the speech corridor.



Revoluto microphone units should not be directly placed back to back, because the acoustical corridor effect does not work in this case. As shown in the previous example the minimum distance should be 15 to 20 cm.



5.3 Electronic signal processing

As previously explained in the fundamentals of Revoluto technology, one boundary can never be avoided – the table upon which the microphone is placed. Reflections caused by the desktop have a negative effect on the microphone's frequency response (see illustration of frequency response with desktop). This effect depends on the characteristics of the table and the exact positioning of the microphone.

These factors are situation-dependent and cannot be pre-configured at the factory. Only seldom is it possible to do without a parametric equalisation of the microphone signals.

This is done to reduce larger bumps in the frequency response. Any resulting holes, on the other hand, should be compensated gently or not at all. Holes in frequency response are significantly harder to hear than the bumps, so they are less critical.

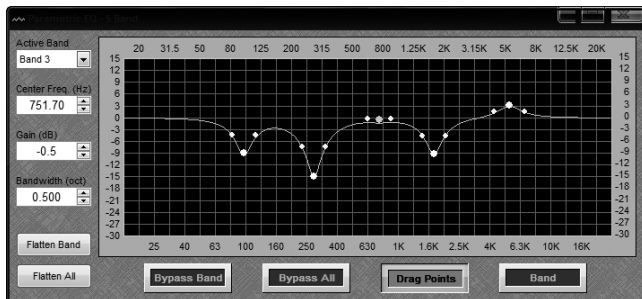
Note:

We recommend signal processing for equalising the microphone signal.

5.4 Everything has its limits – even Revoluto technology

Microphones and microphone units using Revoluto technology are far superior to gooseneck and boundary microphones in many settings and applications. For example, at an equal speaker-to-microphone distance, Revoluto typically provides a feedback limit 6 dB higher than conventional solutions. If the speaker is speaking close up (10 to 15 cm), the gooseneck microphone has an advantage over Revoluto technology at these minimal speaker-to-mic distances. Therefore, a basic requirement for using Revoluto is balanced room acoustics.

When the acoustic conditions are critical, an SHM 2xx or SHM 8xx or a microphone unit with a gooseneck microphone may be more advantageous.



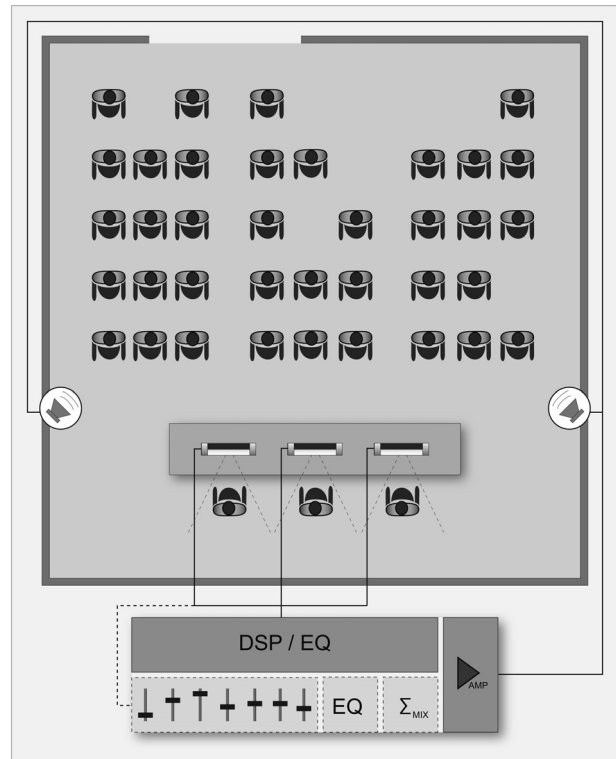
6. Application

6.1 Press conference with MPR110/111

In this example, the MPR microphones are operated by means of an audio DSP in automatic mixed mode or with remote control in order to obtain as much headroom as possible per speaker. Equalisation for room acoustics is also possible in audio DSP mode.

Due to the use of Revoluto technology, it is no longer necessary for the speaker to address the microphone directly, as the pick-up zone is significantly expanded. The speaker can also turn to the right or left without any major loss of sound pressure.

The loudspeakers are positioned in front of the lectern facing the audience. In highly reflective rooms there can be a greater tendency to feedback, in which case corresponding precautions have to be taken.

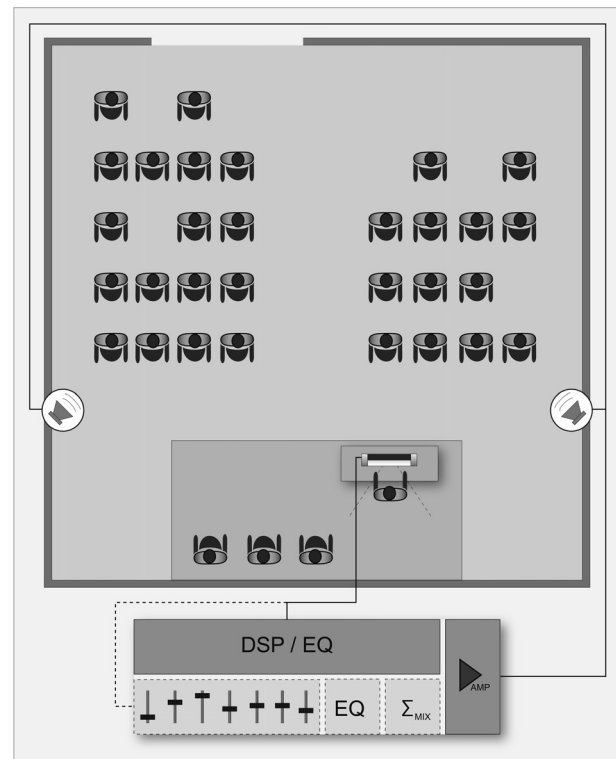


6.2 Lectern with MPR 110/111

In this case, the MPR microphone is operated by means of an audio DSP. Equalisation for room acoustics is also possible in audio DSP mode.

Due to the use of Revoluto technology, it is no longer necessary for the speaker to address the microphone directly, as the pick-up zone is significantly expanded. The speaker can also turn to the right or left without any major loss of sound pressure.

The loudspeakers are positioned in front of the lectern facing the audience. In highly reflective rooms there can be a greater tendency to feedback, in which case corresponding precautions have to be taken.

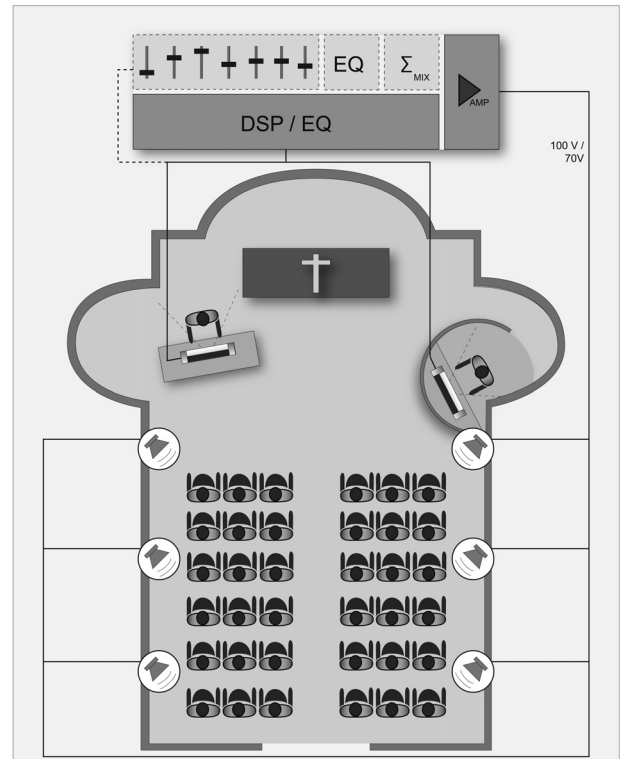


6.3 Church

In this example, the MPR microphones are operated by means of an audio DSP in automatic mixed mode in order to obtain as much headroom as possible in the building (pulpit, altar). Equalization for room acoustics is also possible in audio DSP mode.

Due to the use of Revoluto technology, it is no longer necessary for the speaker to address the microphone directly, as the pick-up zone is significantly expanded. The speaker can also turn to the right or left without any major loss of sound pressure.

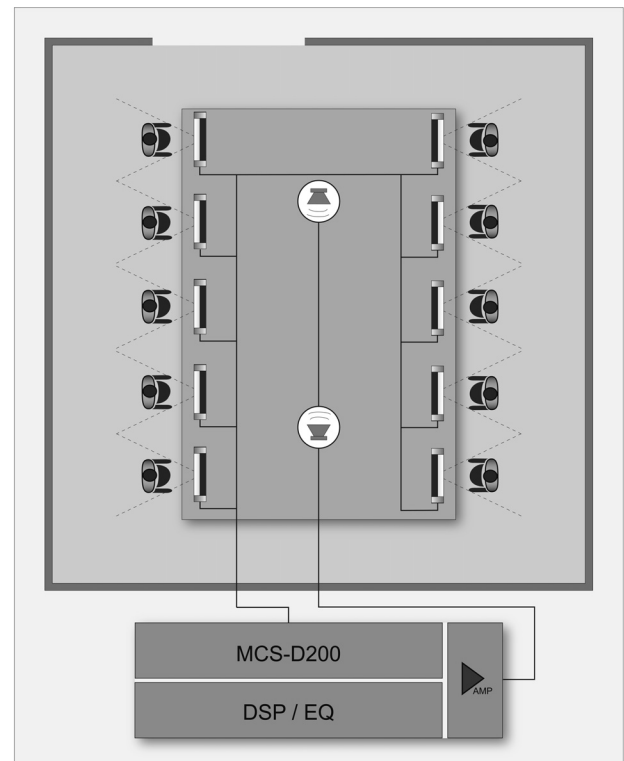
The loudspeakers are positioned in front of the pulpit and the altar facing the congregation. In highly reflective rooms there can be a greater tendency to feedback, in which case corresponding precautions have to be taken.



6.4 Conference system with MCS-D 31xx and central sound reinforcement

Limitation of the maximum number of open microphones (NOM) prevents headroom reduction. The microphone unit loudspeakers can be adjusted to the acoustics of the room via a cluster channel. The ceiling loudspeakers serve to support the in-built loudspeakers in order to improve intelligibility.

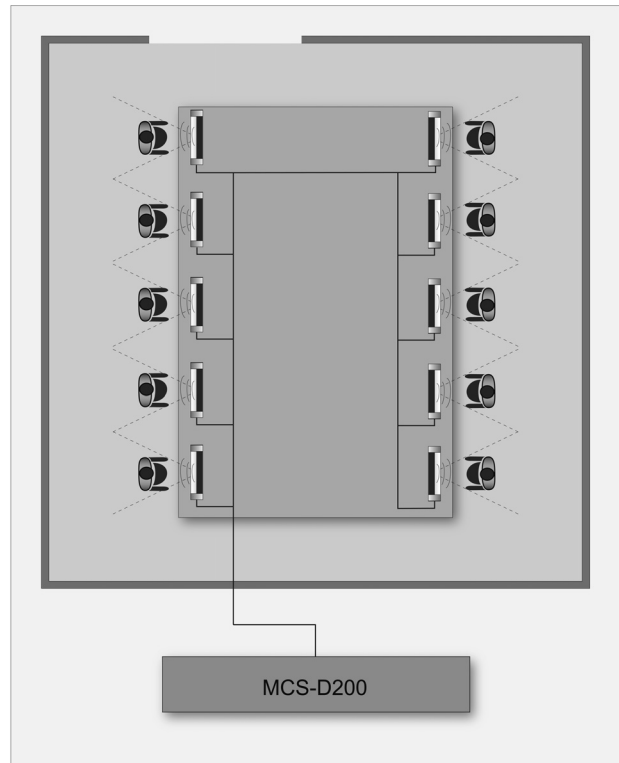
Due to the use of Revoluto technology, it is no longer necessary for the speaker to address the microphone directly, as the pick-up zone is significantly expanded. The speaker can also turn to the right or left without any major loss of sound pressure.



6.5 Conference system with MCS-D 31xx

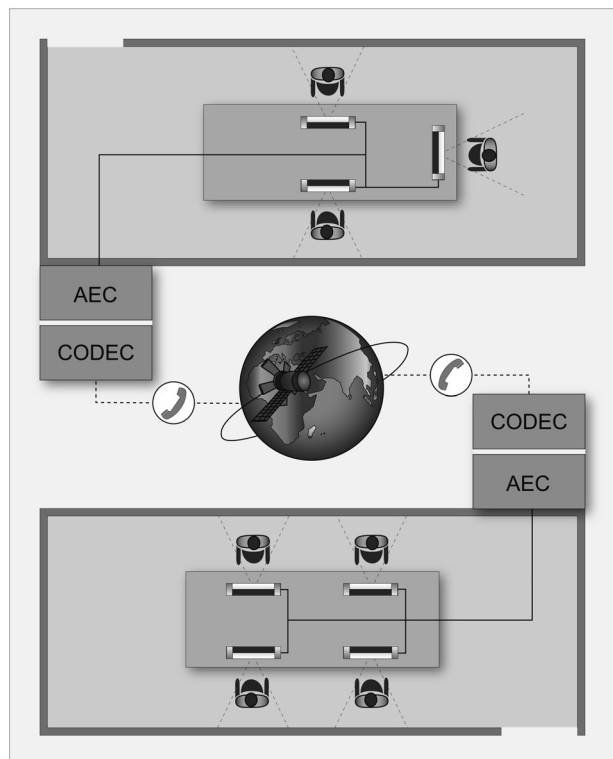
Limitation of the maximum number of open microphones (NOM) prevents headroom reduction. The microphone unit loudspeakers can be adjusted to the acoustics of the room via a cluster channel. The microphone unit loudspeakers alone provide the sound reinforcement for the delegates.

Due to the use of Revoluto technology, it is no longer necessary for the speaker to address the microphone directly, as the pick-up zone is significantly expanded. The speaker can also turn to the right or left without any major loss of sound pressure.



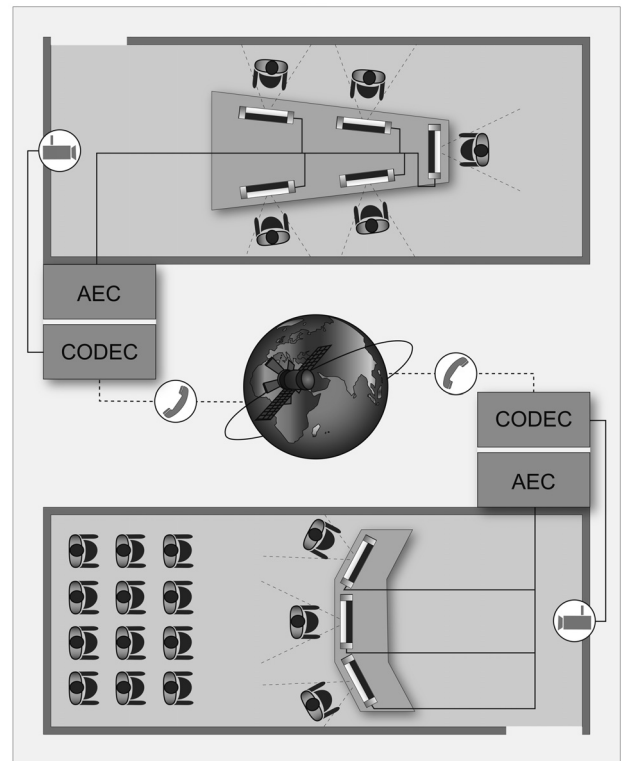
6.6 Teleconference with MPR 110/111

The MPR microphones are connected to a teleconference codec via an echo-cancelling DSP. The corridor characteristic of Revoluto technology achieves significantly higher intelligibility compared to boundary microphones because it picks up a lower proportion of ambient noise. Even if the speaker's head is turned away from the microphone, this does not lead to a major loss of sound pressure. The useful signal is then transmitted to the remote unit by the codec.



6.7 Video conference with MPR 110/111

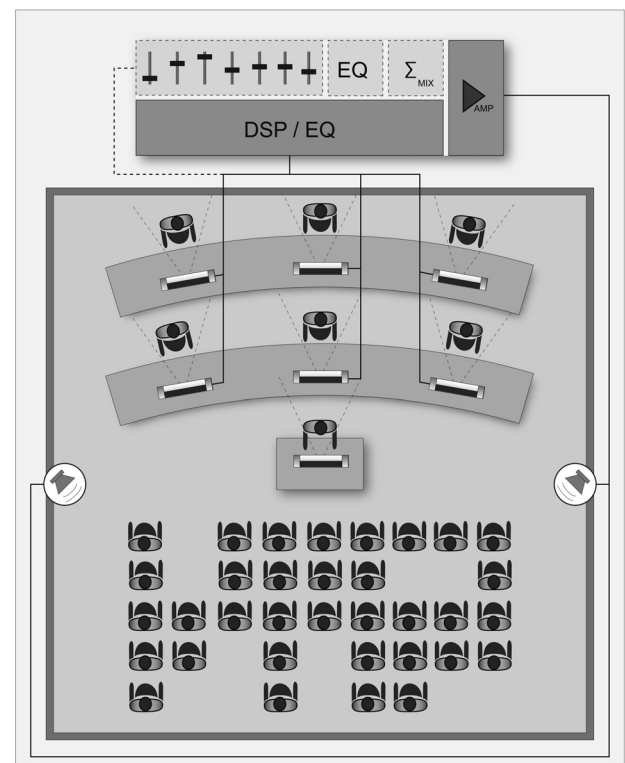
The MPR microphones are connected to a video conference codec via an echo-cancelling DSP. The corridor characteristic of Revoluto technology achieves significantly higher intelligibility compared to boundary microphones because it picks up a lower proportion of ambient noise. Even if the speaker's head is turned away from the microphone, this does not lead to a major loss of sound pressure. The camera image of the speaker is not obstructed by gooseneck microphones. The useful signal is transmitted to the remote unit by the codec.



6.8 Conference system in conference hall with MCS-D 31xx and central sound reinforcement

Limitation of the maximum number of open microphones (NOM) prevents headroom reduction. The microphone unit loudspeakers can be adjusted to the acoustics of the room via a cluster channel. The central sound reinforcement for the audience is set up in front of the microphone units facing the audience.

Due to the use of Revoluto technology, it is no longer necessary for the speaker to address the microphone directly, as the pick-up zone is significantly expanded. The speaker can also turn to the right or left without any major loss of sound pressure.

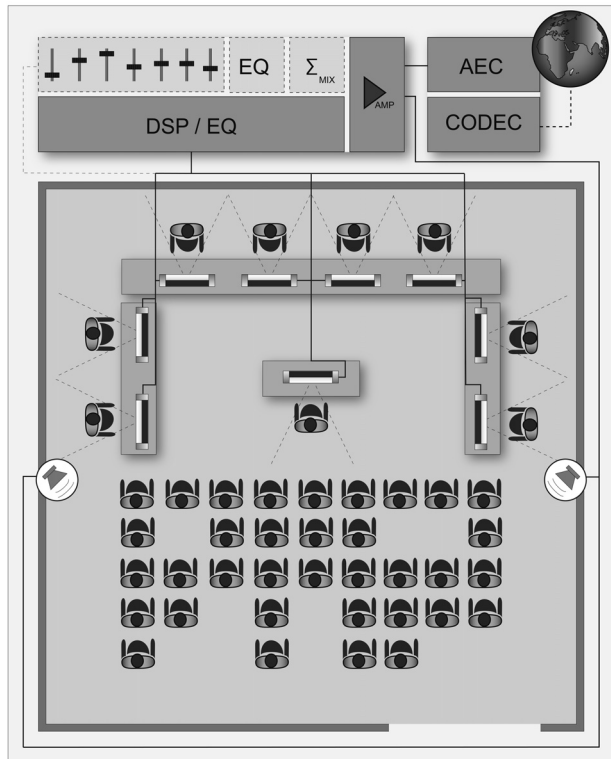


6.9 Court room

Limitation of the maximum number of open microphones (NOM) prevents headroom reduction. The microphone unit loudspeakers can be adjusted to the acoustics of the room via a cluster channel. The loudspeakers in the court room serve to support the built-in loudspeakers in order to improve intelligibility.

Due to the use of Revoluto technology, it is no longer necessary for the speaker to address the microphone directly, as the pick-up zone is significantly expanded. The speaker can also turn to the right or left without any major loss of sound pressure.

Alternatively, an application of this kind is also possible using an audio DSP and MPR 110/111 microphones.

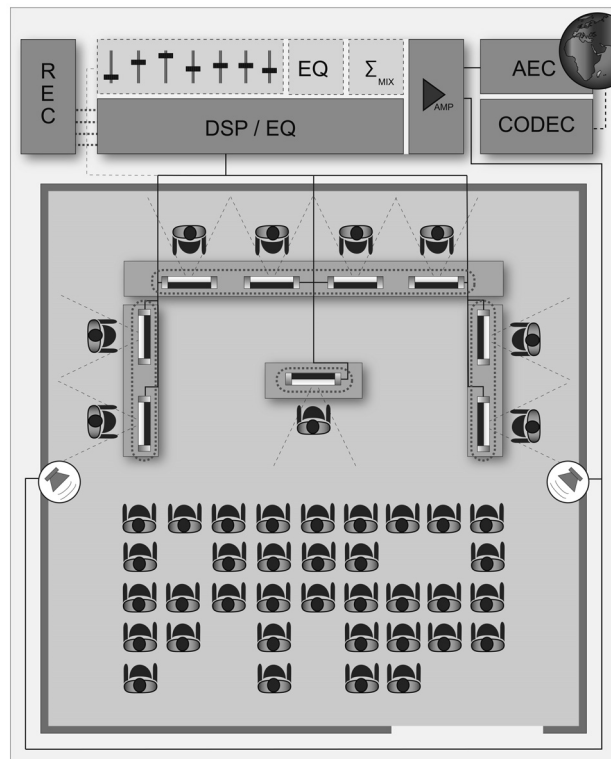


6.10 Court room with recording

Limitation of the maximum number of open microphones (NOM) prevents headroom reduction. The microphone unit loudspeakers can be adjusted to the acoustics of the room via a cluster channel. The loudspeakers in the court room serve to support the built-in loudspeakers in order to improve intelligibility.

Due to the use of Revoluto technology, it is no longer necessary for the speaker to address the microphone directly, as the pick-up zone is significantly expanded. The speaker can also turn to the right or left without any major loss of sound pressure.

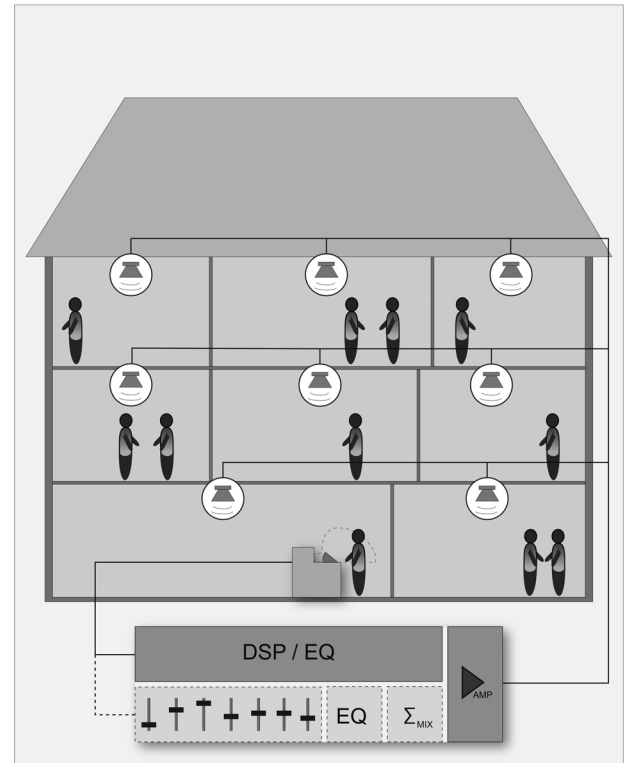
Alternatively, an application of this kind is also possible using an audio DSP and MPR 110/111 microphones. Separate audio out ports for witnesses, prosecution, defence and judge permit single-track recording for each of the user groups in this configuration.



6.11 Announcement

The MPR 111 is operated in "external logic" mode. A gong signal is produced in the ELA or via an audio DSP by pressing the push-button. The announcement is then enabled by the logic drive of the central ELA unit or audio DSP.

Due to the use of Revoluto technology, it is no longer necessary for the speaker to address the microphone directly, as the pick-up zone is significantly expanded. The speaker can also turn to the right or left without any major loss of sound pressure.



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