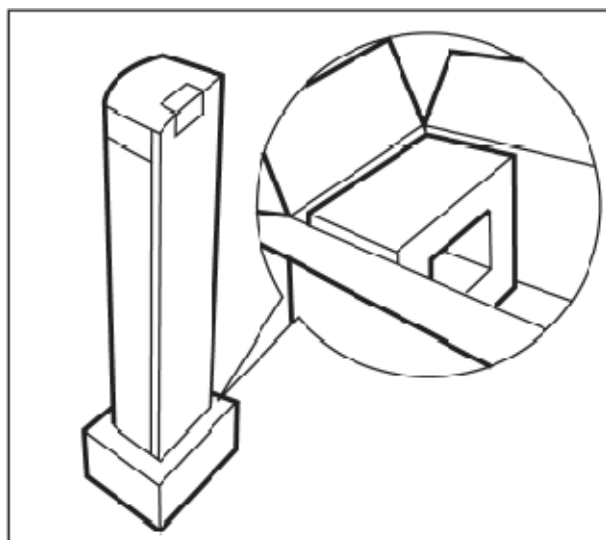
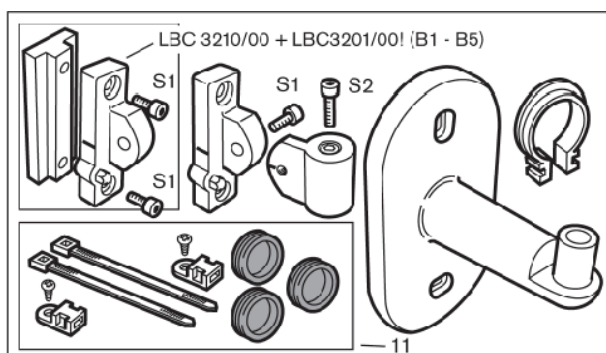
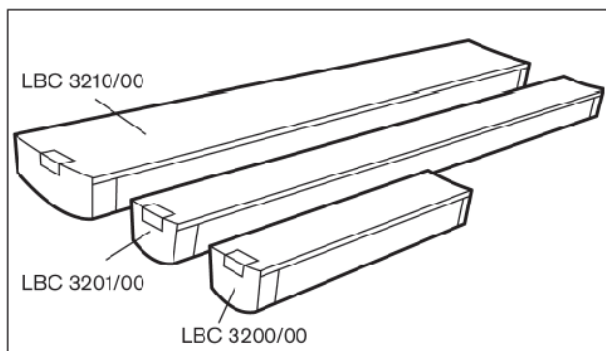


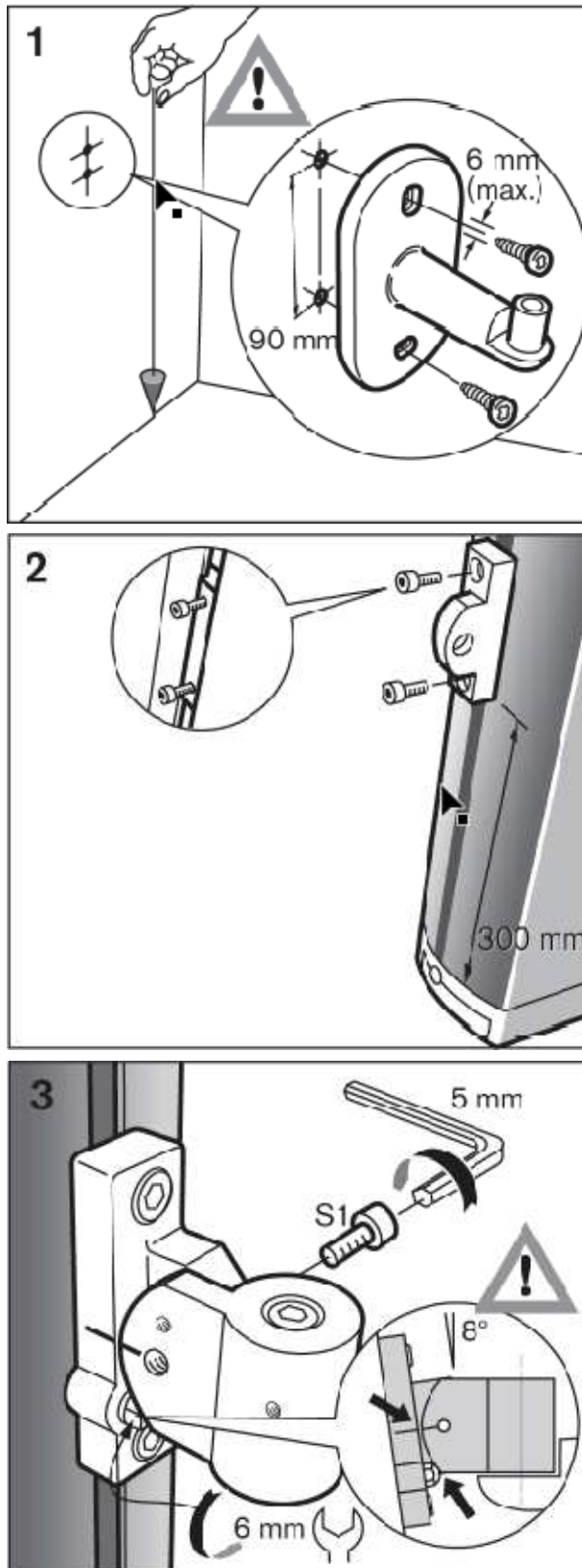
Line array loudspeaker

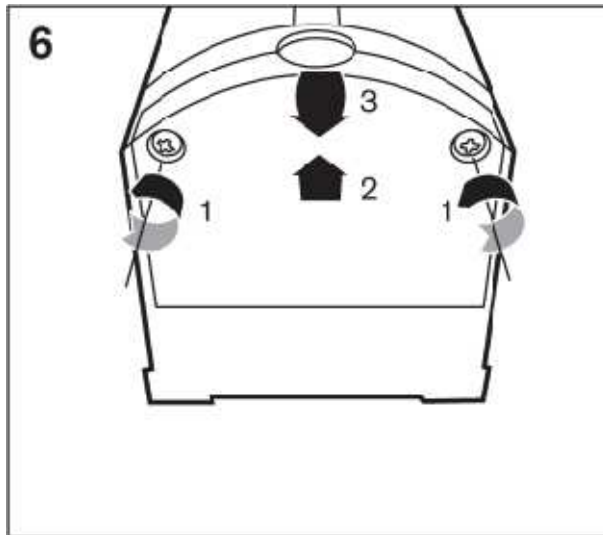
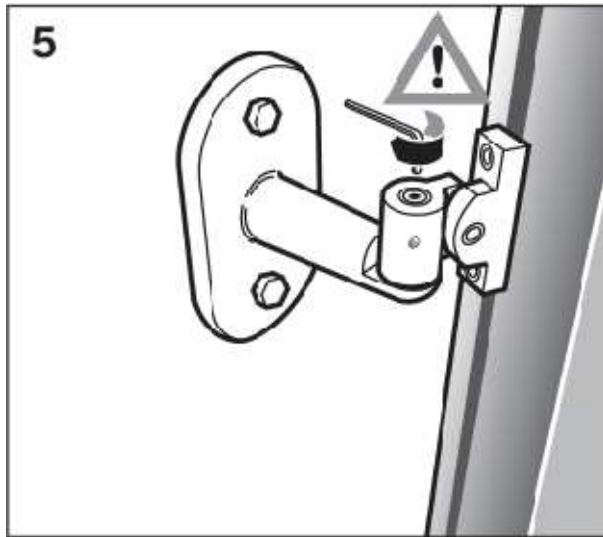
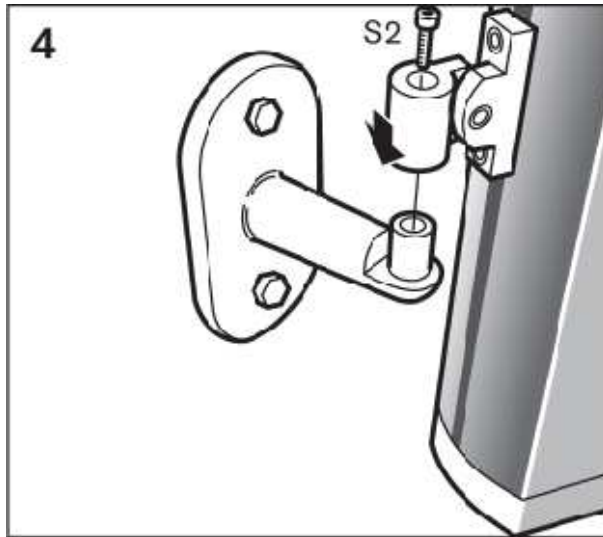
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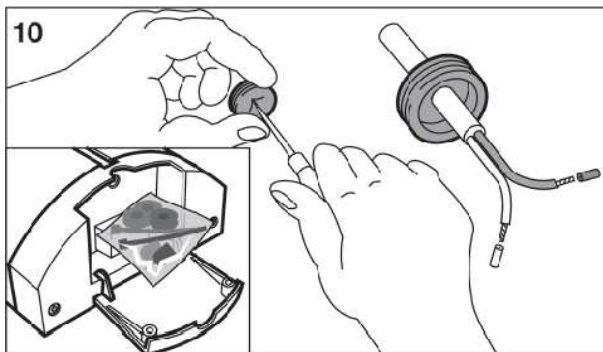
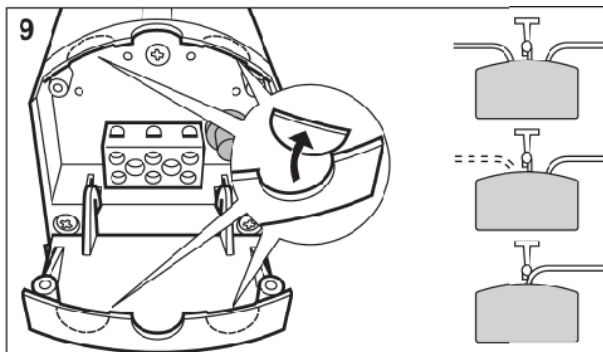
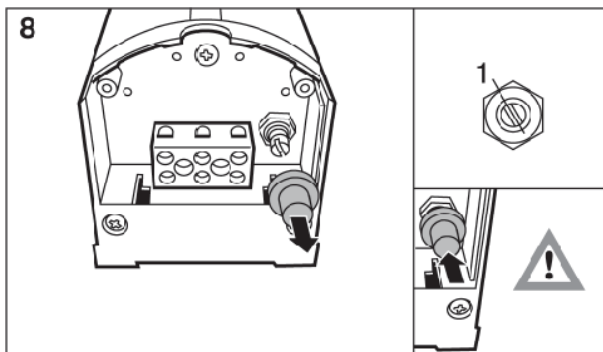
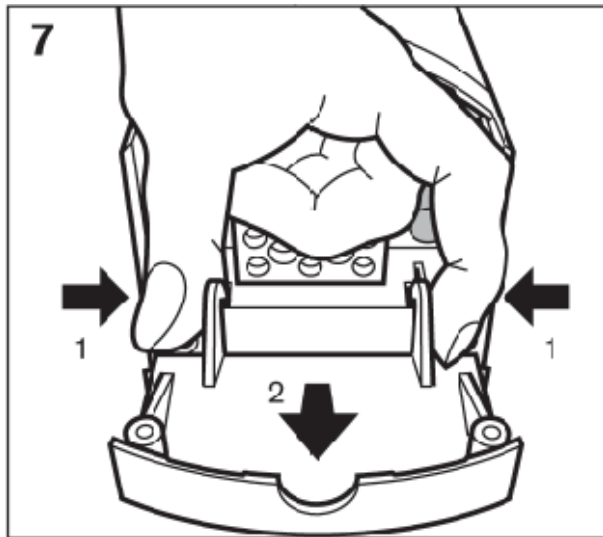


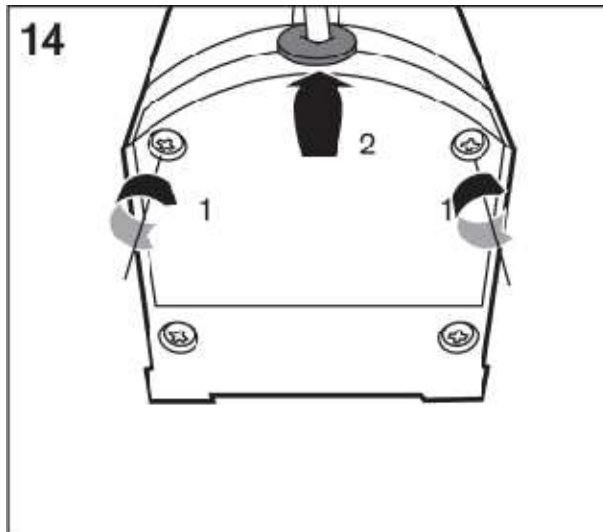
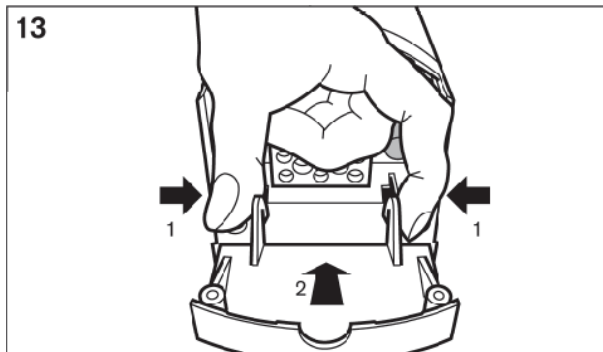
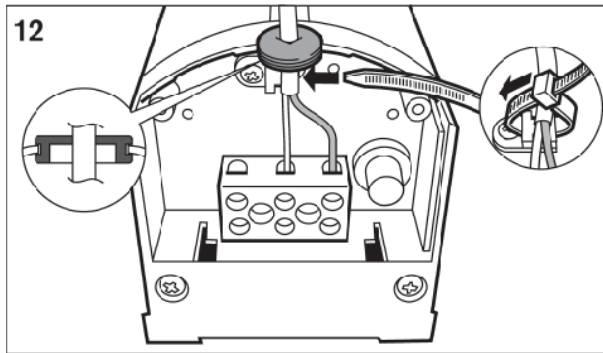
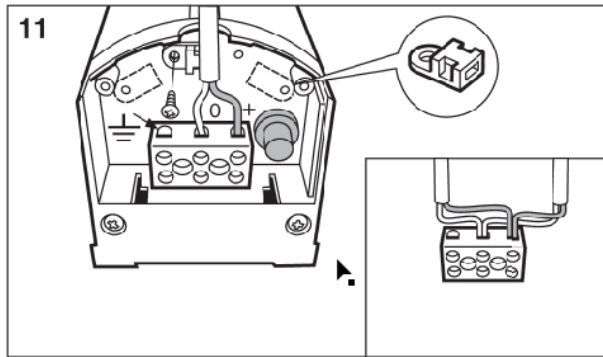
1 Installation

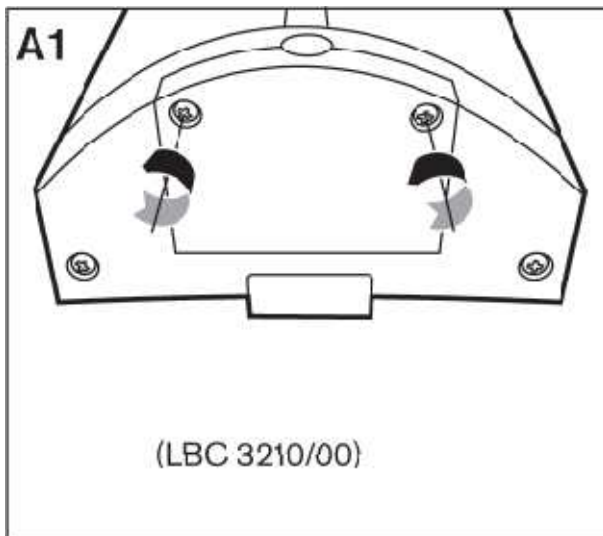
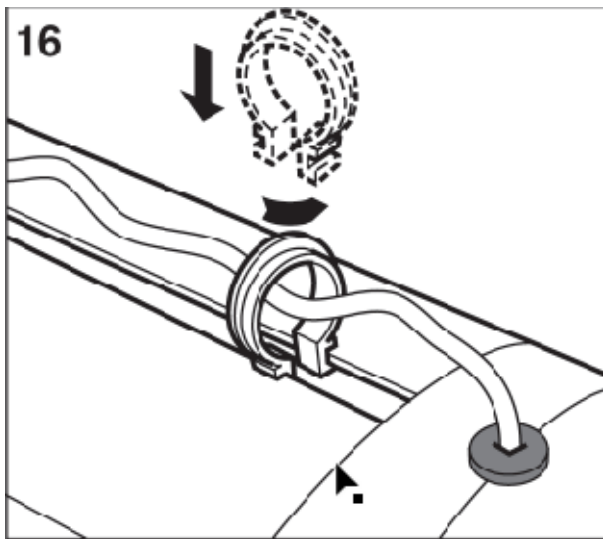
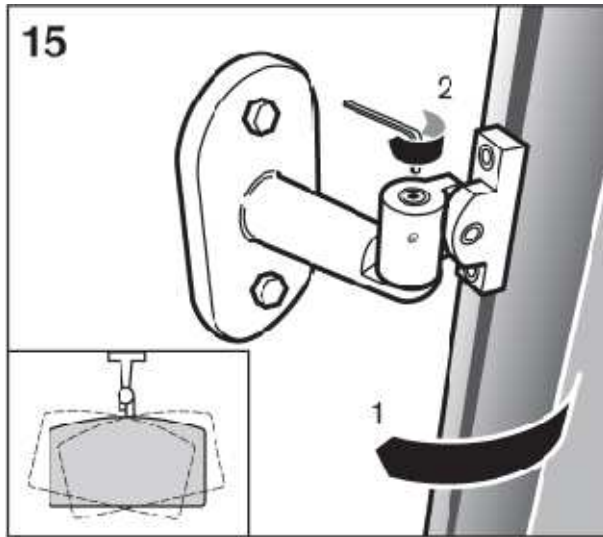


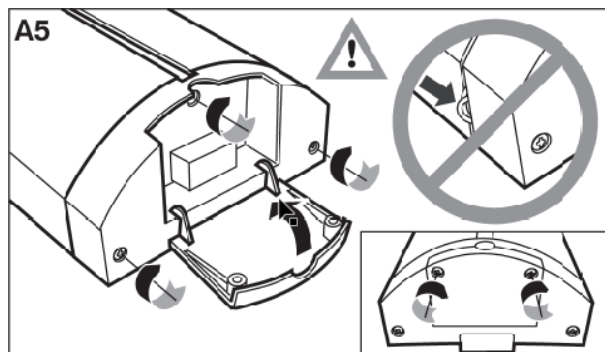
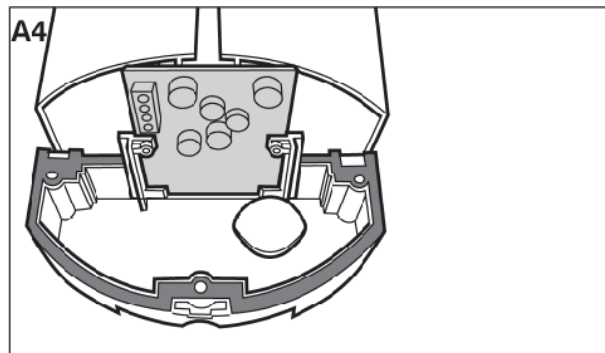
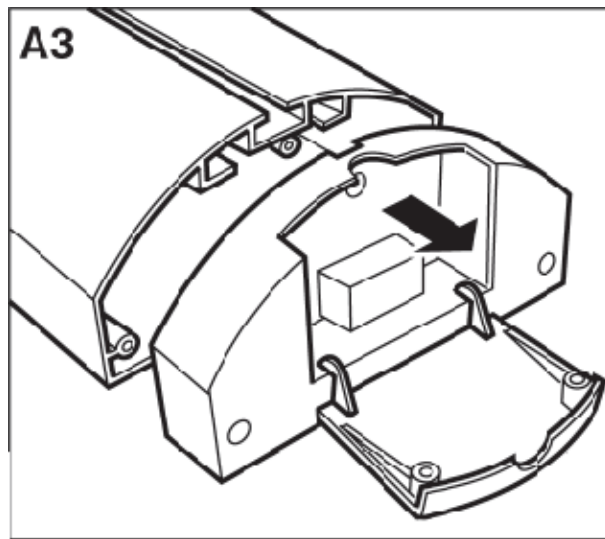
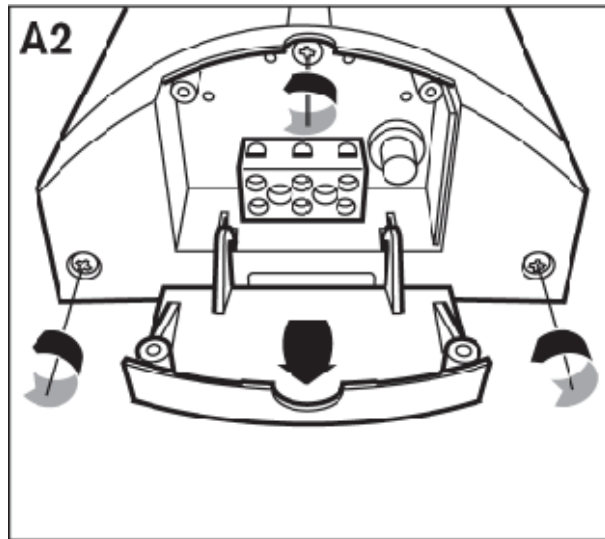


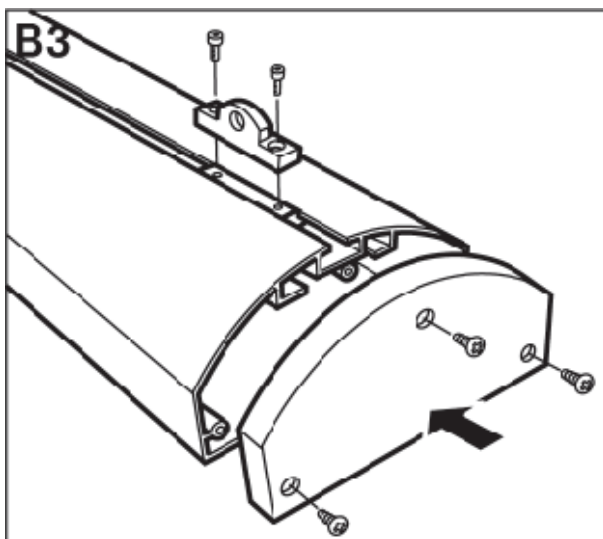
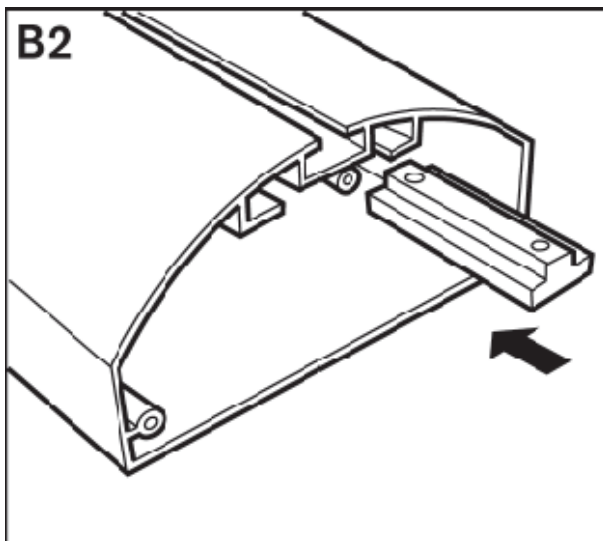
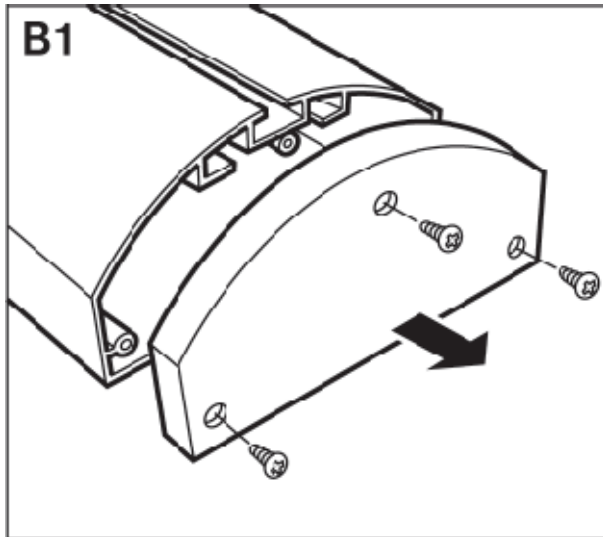


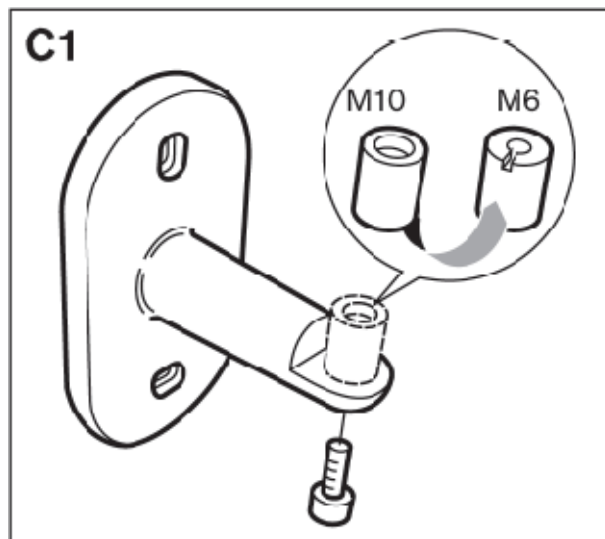
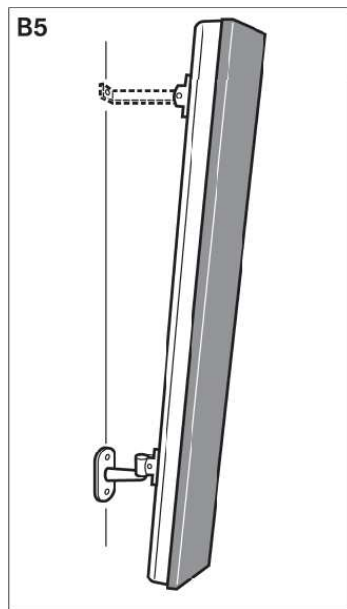
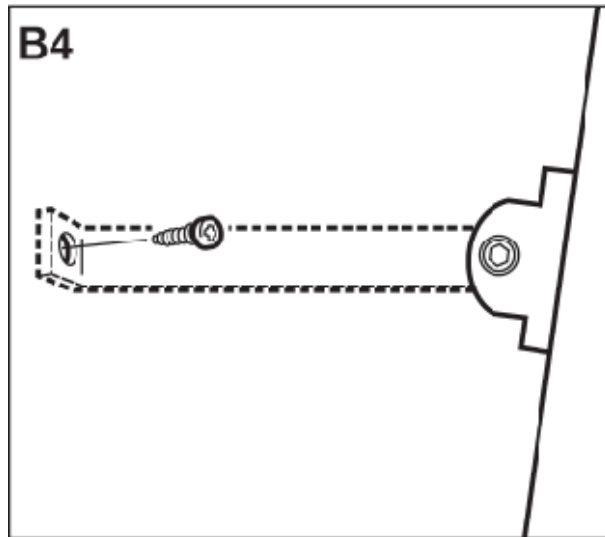


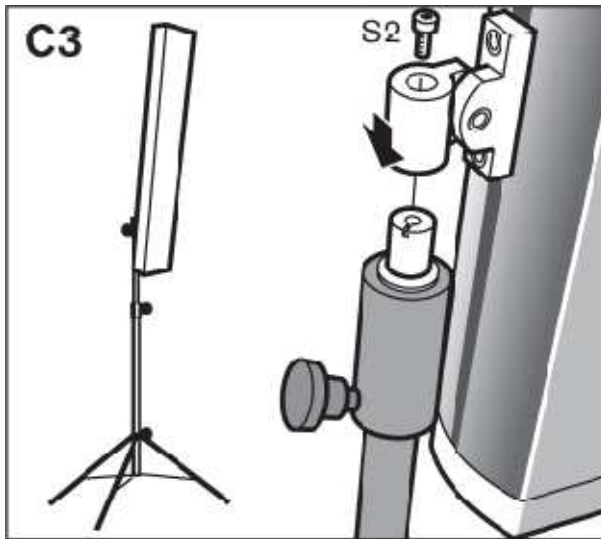
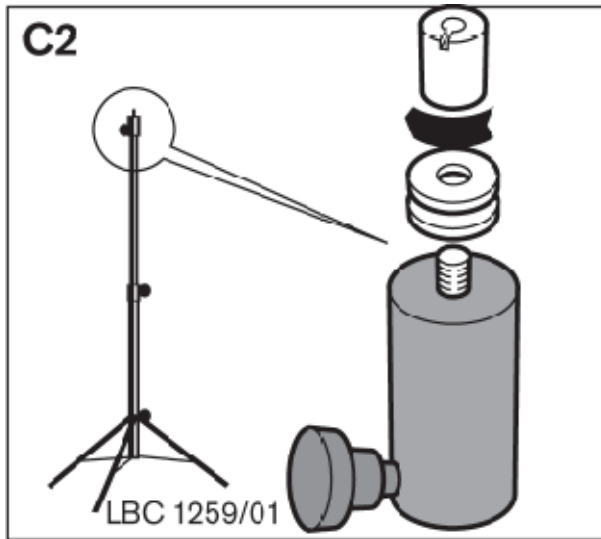












2

Listening area and related mounting height for LBC3200/00

Determining mounting height and angle for the LBC3200 loudspeaker array:

1. Determine the dimensions of the desired 'listening area' (a horizontal plane at the level of the listeners' ears – refer to the dashed line in figure 1).
2. Determine the angle at which the loudspeaker array is to be mounted. The array is designed to beam sound just above the listeners' heads, and it is recommended not to exceed an angle of 6". There are two approaches, each with specific pros and cons.
 - Approach 1: Maximized listening area
 - When a large listening area is desired, an angle of around 3" is recommended (see figure 1). Note that when walking away from the loudspeaker array, the sound pressure level will decrease by an amount that depends on the room reverberation. To hear high tones clearly, the listener should be able to see the loudspeaker array.
 - Approach 2: Minimized sound pressure level variation
 - When less sound pressure level variation is desired, an angle of 5° is recommended. Note that this reduces the size of the total listening area compared to approach 1, and that the space very close to the loudspeaker array ('A' in figure 2) is not part of the listening area. Diagram 1 shows the relationship between 'A' and the mounting height of the loudspeaker array when using a 5" installation angle.
1. After selecting the most appropriate approach (mounting angle), the mounting height of the loudspeaker is determined by focusing the 0°-axis of the loudspeaker array to the desired position just above ear level of the furthest listener. This can be adjusted by mounting the loudspeaker higher or lower on the wall.

Now you can mount the loudspeaker array for optimal acoustic performance.

Installation questions and answers:

- **May I install the LBC3200 loudspeaker array the same as LBC3210 or LBC3201?**
- This loudspeaker array is designed for small and medium indoor environments. The optimal acoustical performance of this loudspeaker array is obtained by beaming the sound just above the listeners' heads. When this loudspeaker array is mounted as the LBC3210 or LBC3201, a very small listening area results. This is also the reason for not using an angle greater than 6°.
- **If I cannot see the loudspeaker array, does it mean that I cannot hear high tones?**
- You can compare high tones with light. When something is between you and the light source, you do not see the light source with its full power. We call this shadow. When a lot of people are sitting between you and the loudspeaker, you are sitting in the sound shadow. We experience that as a reduction of high tones.

Background information:

- Because of the many installing angles it is difficult to give a defined shape of the radiated sound from the loudspeaker array.
- By installing the loudspeaker array at a small angle, a (very) large listening area can be reached. Depending on the amount of reverberation in the room and the sound shadow (people or objects in front of a listener who are blocking the direct sound source) the speech intelligibility on a far position may be low. In these situations, it is better to use more loudspeaker arrays to split the listening area.
- When you move further than the maximum position of the listening area (more than the maximum distance from the loudspeaker array), only the sound pressure level will decrease. There is almost no tone height variation. The decreasing of sound pressure level depends strongly on the reverberation in the room.
- When you are too close to the loudspeaker array (less than the minimum distance from the loudspeaker array) and are using the 5° approach a decline of the high tones will very soon occur.
- Because the loudspeakers are designed to beam the sound just above the listeners' heads, it is better not to mount the loudspeakers too high above the listening area.
- To determine exactly where the edges of the listening area are in your situation, you have to carry out a practical test at the location where the loudspeaker array is installed. This is a job for an experienced listener with well-trained ears. To do so, put pink noise through the loudspeaker array. It is better to reduce the lower tones for this test, as they do not contribute to speech intelligibility. Walk around in the listening area and listen to the high tones. The places where the high tones decrease rapidly are the edges of the listening area.

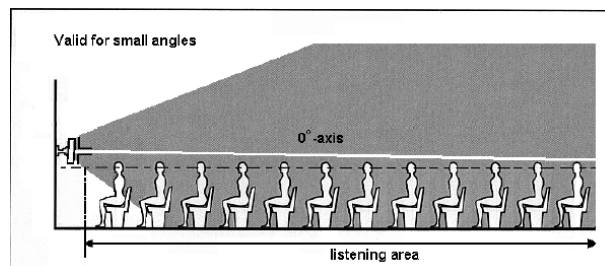


Figure 1: side view of loudspeaker array radiation mounted to the wall with a small angle

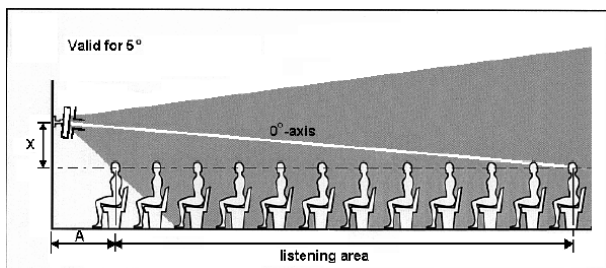


Figure 2: side view of loudspeaker array radiation mounted to the wall with a 5° angle

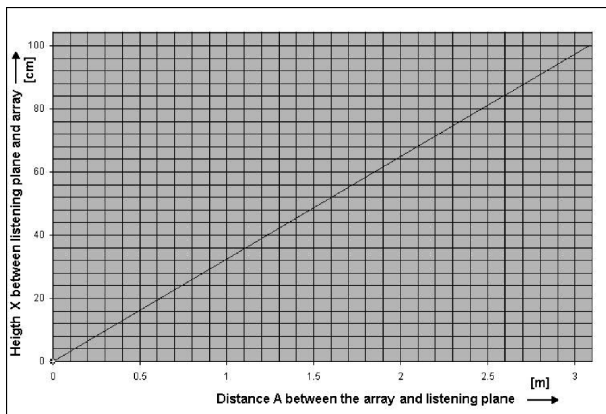


Diagram 1: relation between listening area distance and loudspeaker array

3 Listening area and related mounting height for LBC3201/00

How to use this mounting method:

1. Determine the dimensions of the desired 'listening area' (a horizontal plane at the level of the listeners' ears – refer to the dashed line in figure 1).
2. Measure the maximum distance from loudspeaker array to the last listener in the listening area (corresponding to 'B' in figures 1, 2 and 3).
3. Refer to diagram 1, and trace upwards from the maximum distance on the horizontal axis. From the vertical intersection with diagonal B-line, you go horizontal to the vertical axis. The X-value (height of loudspeaker array mounting bracket above the listening plane, 'X' in figure 1) is standing on this axis. The horizontal intersections with other diagonal lines provide information about the dimensions of the listening area. These numbers are related to figures 2 and 3 (see also example below).
4. Figure 2 shows the 1 kHz octave shape radiated by the loudspeaker array and figure 3 shows the 4 kHz octave shape radiation. The listening area with the optimal acoustic performance is in these shapes. Ensure the 4 kHz shape with the dimensions obtained using diagram 1 adequately covers the desired listening area.
5. If the desired listening area is covered by the 4 kHz shape, the X-value on the vertical axis shows at what height the loudspeaker array must be mounted above the listening plane. Note that the loudspeaker array must be mounted at an angle of 8° at the chosen height!

Now you can mount the loudspeaker array for optimal acoustic performance.

Diagram example:

The maximum distance from loudspeaker array to last listener is 15 m. Tracing upwards from the 15 m point on the horizontal axis of diagram 1 to the diagonal B-line and then sideways to the vertical axis, the intersections with the other diagonal lines provide dimensions of the listening planes. In this example:

F-line (listening plane side length of 4 kHz) = 11.1 m

C-line (listening plane length) = 11 m

E-line (half width listening plane of 4 kHz) = 9.3 m

A-line (minimum distance to listening plane) = 3.9 m

On the vertical axis, the X-value (the height between the listening plane and loudspeaker array mounting bracket) is 1.8 m.

Installation questions and answers:

- **The desired listening area is too large and does not fit in the 4 kHz shape.**
- Try a different loudspeaker array mounting height or use more loudspeaker arrays to get a larger listening area.
- **Why use an angle of 8° for the loudspeaker array?**
- The radiated shapes shown in figures 2 and 3 with the dimensions in diagram 1 are only valid when the loudspeaker array is mounted at an angle of 8°. Only this situation provides constant sound pressure level and frequency response (constant directivity) in the listening area.
- **Can I use the loudspeaker array with another angle?**
- You can use the loudspeaker arrays with another angle but you will not get the optimum acoustic performance. For example, greater sound pressure level variation will be audible in the listening area. The values in diagram 1 are not valid for other angles. It is recommended never to use an angle greater than 8°.
- **The loudspeaker array cannot be mounted as high as desired.**

- If the height cannot be reached, for example, by limitation of the ceiling, use an angle of less than 8°. Focus the 0°-axis of the loudspeaker array to the desired maximum position (see figure 4). Note that the table in diagram 1 and shapes in figures 2 and 3 are not valid for this situation. Check in the listening area if the speech intelligibility is acceptable.

Background information:

- The shapes are defined in an anechoic environment. In these shapes at anechoic conditions, you have a maximum of 6 dB sound pressure variation and much less perceived frequency response variation. In areas with normal or high reverberations, less sound pressure level variation takes place and the size of shapes will be bigger. The perceived frequency response in this shape will then be almost constant.
- When you go further than the maximum position of the listening area (beyond the maximum distance from the loudspeaker array) only the sound pressure level will decrease. There is almost no tone height variation. The decrease in sound pressure level depends strongly on the reverberation of the room.
- When you move too close to the loudspeaker array (less than the minimum distance from the loudspeaker array) a lack of high tones will very soon occur.
- Depending on the amount of reverberation in the room and the sound shadow (people or objects in front of a listener who/that block the direct sound source), the speech intelligibility at the furthest positions may be low. In these situations, it is better to use more loudspeaker arrays to split the listening area.
- The side lines of the shapes of figure 2 and 3 are the -6 dB points related to the sound pressure level on the 0°-axis.
- To get the best speech intelligibility, define a listening area where the 4 kHz octave shape covers the whole area.
- To determine exactly where the edges of the listening area are in your situation, you have to carry out a practical test at the location where the loudspeaker array is installed. This is a job for an experienced listener with well-trained ears. To do so, put pink noise through the loudspeaker array. It is better to reduce the lower tones for this test, as they do not contribute to speech intelligibility. Walk around in the listening area and listen to the high tones. The places where the high tones decrease rapidly are the edges of the listening area.

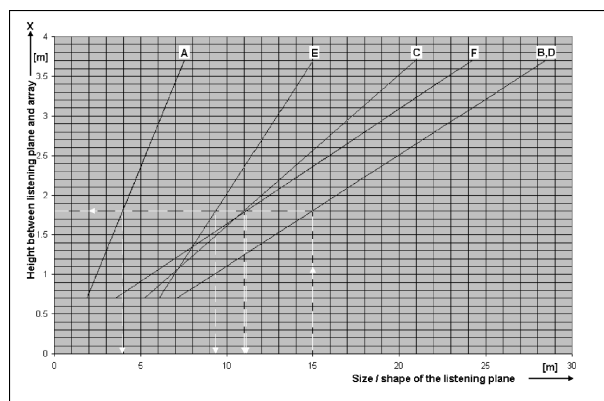


Diagram 1: relation between listening area and loudspeaker array mounting height

Diagonal line meanings:

- B-line: maximum distance from loudspeaker array to last listener.
- D-line: half-width listening plane at 1 kHz
- F-line: listening plane side length of 4 kHz
- C-line: listening plane length
- E-line: half width listening plane of 4 kHz
- A-line: minimum distance to listening plane

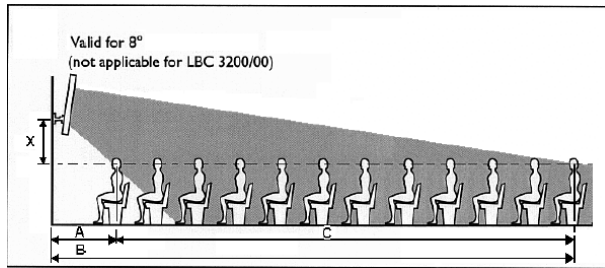


Figure 1: side view of loudspeaker array radiation and listening plan

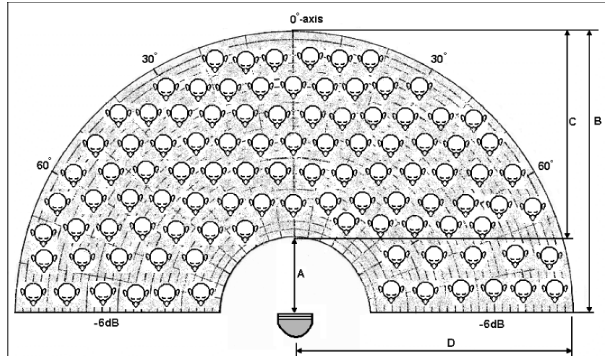


Figure 2: 1 kHz octave shape of the loudspeaker array

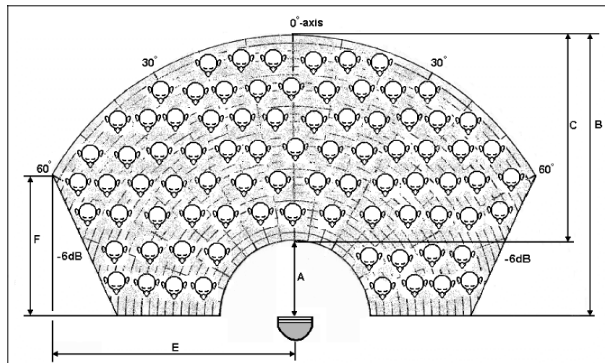


Figure 3: 4 kHz octave shape of the loudspeaker array

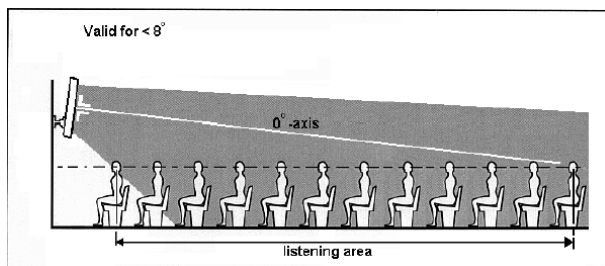


Figure 4: focus the 0°-axis of the loudspeaker array to the maximum position

4 Listening area and related mounting height for LBC3210/00

How to use this mounting method:

1. Determine the dimensions of the desired 'listening area' (a horizontal plane at the level of the listeners' ears – refer to the dashed line in figure 1).
2. Measure the maximum distance from loudspeaker array to the last listener in the listening area (corresponding to 'B' in figures 1, 2 and 3).
3. Refer to diagram 1, and trace upwards from the maximum distance on the horizontal axis. From the vertical intersection with diagonal B-line, you go horizontal to the vertical axis. The X-value (height of loudspeaker array mounting bracket above the listening plane, 'X' in figure 1) is standing on this axis. The horizontal intersections with other diagonal lines provide information about the dimensions of the listening area. These numbers are related to figures 2 and 3 (see also example below).
4. Figure 2 shows the 1 kHz octave shape radiated by the loudspeaker array and figure 3 shows the 4 kHz octave shape radiation. The listening area with the optimal acoustic performance is in these shapes. Ensure the 4 kHz shape with the dimensions obtained using diagram 1 adequately covers the desired listening area.
5. If the desired listening area is covered by the 4 kHz shape, the X-value on the vertical axis shows at what height the loudspeaker array must be mounted above the listening plane. Note that the loudspeaker array must be mounted at an angle of 8° at the chosen height!

Now you can mount the loudspeaker array for optimal acoustic performance.

Diagram example:

The maximum distance from loudspeaker array to last listener is 15 m. Tracing upwards from the 15 m point on the horizontal axis of diagram 1 to the diagonal B-line and then sideways to the vertical axis, the intersections with the other diagonal lines provide dimensions of the listening planes. In this example:

F-line (listening plane side length of 4 kHz) = 11.1 m

C-line (listening plane length) = 11 m

E-line (half width listening plane of 4 kHz) = 9.3 m

A-line (minimum distance to listening plane) = 3.9 m

On the vertical axis, the X-value (the height between the listening plane and loudspeaker array mounting bracket) is 1.8 m.

Installation questions and answers:

- **The desired listening area is too large and does not fit in the 4 kHz shape.**
- Try a different loudspeaker array mounting height or use more loudspeaker arrays to get a larger listening area.
- **Why use an angle of 8° for the loudspeaker array?**
- The radiated shapes shown in figures 2 and 3 with the dimensions in diagram 1 are only valid when the loudspeaker array is mounted at an angle of 8°. Only this situation provides constant sound pressure level and frequency response (constant directivity) in the listening area.
- **Can I use the loudspeaker array with another angle?**
- You can use the loudspeaker arrays with another angle but you will not get the optimum acoustic performance. For example, greater sound pressure level variation will be audible in the listening area. The values in diagram 1 are not valid for other angles. It is recommended never to use an angle greater than 8°.
- **The loudspeaker array cannot be mounted as high as desired.**

- If the height cannot be reached, for example, by limitation of the ceiling, use an angle of less than 8°. Focus the 0°-axis of the loudspeaker array to the desired maximum position (see figure 4). Note that the table in diagram 1 and shapes in figures 2 and 3 are not valid for this situation. Check in the listening area if the speech intelligibility is acceptable.

Background information:

- The shapes are defined in an anechoic environment. In these shapes at anechoic conditions, you have a maximum of 6 dB sound pressure variation and much less perceived frequency response variation. In areas with normal or high reverberations, less sound pressure level variation takes place and the size of shapes will be bigger. The perceived frequency response in this shape will then be almost constant.
- When you go further than the maximum position of the listening area (beyond the maximum distance from the loudspeaker array) only the sound pressure level will decrease. There is almost no tone height variation. The decrease in sound pressure level depends strongly on the reverberation of the room.
- When you move too close to the loudspeaker array (less than the minimum distance from the loudspeaker array) a lack of high tones will very soon occur.
- Depending on the amount of reverberation in the room and the sound shadow (people or objects in front of a listener who/that block the direct sound source), the speech intelligibility at the furthest positions may be low. In these situations, it is better to use more loudspeaker arrays to split the listening area.
- The side lines of the shapes of figure 2 and 3 are the -6 dB points related to the sound pressure level on the 0°-axis.
- To get the best speech intelligibility, define a listening area where the 4 kHz octave shape covers the whole area.
- To determine exactly where the edges of the listening are in your situation, you have to carry out a practical test at the location where the loudspeaker array is installed. This is a job for an experienced listener with well-trained ears. To do so, put pink noise through the loudspeaker array. It is better to reduce the lower tones for this test, as they do not contribute to speech intelligibility. Walk around in the listening area and listen to the high tones. The places where the high tones decrease rapidly are the edges of the listening area.

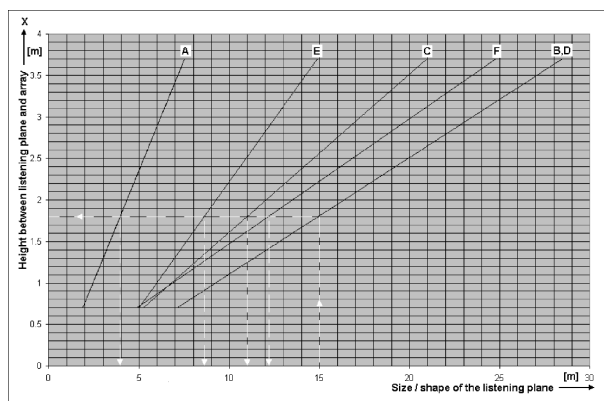


Diagram 1: relation between listening area and loudspeaker array mounting height

Diagonal line meanings:

B-line: maximum distance from loudspeaker array to last listener.

D-line: half-width listening plane at 1 kHz

F-line: listening plane side length of 4 kHz

C-line: listening plane length

E-line: half width listening plane of 4 kHz

A-line: minimum distance to listening plane

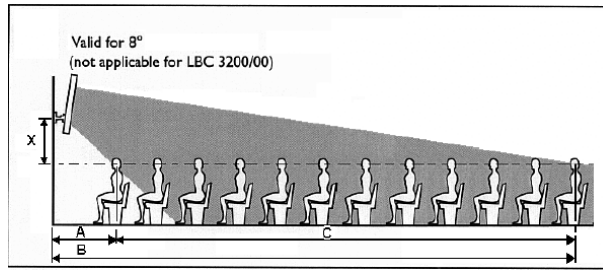


Figure 1: side view of loudspeaker array radiation and listening plane

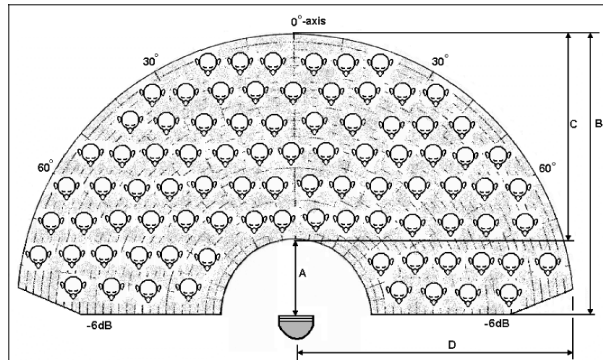


Figure 2: 1 kHz octave shape of the loudspeaker array

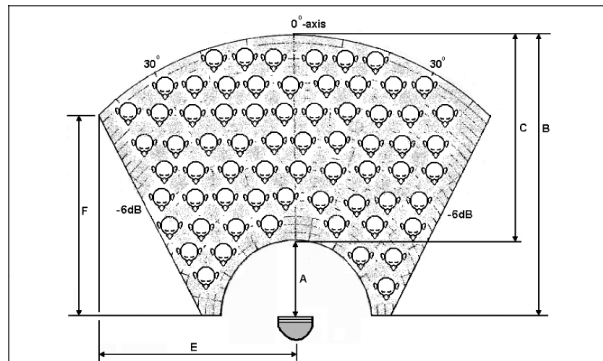


Figure 3: 4 kHz octave shape of the loudspeaker array

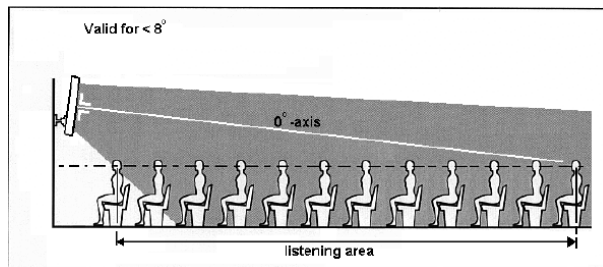


Figure 4: focus the 0°-axis of the loudspeaker array to the maximum position

5 Technical data

LBC 3200/00

Electrical*

Rated power	30 / 15 / 7.5 W	
Sound pressure level at 30 W / 1 W (1 kHz, 1 m)	106 / 91 dB (SPL)	
Sound pressure level at 30 W / 1 W (1 kHz, 4 m)	91 / 76 dB (SPL)	
Effective frequency range (-10 dB)	190 Hz to 18 kHz	
Opening angle	1 kHz / 4 kHz (-6 dB)	
horizontal	220° / 130°	
vertical	70° / 18°	
Rated input voltage		100 V
Rated impedance	30 W	333 Ohm
	15 W	667 Ohm
	7.5 W	1333 Ohm
Connector	Screw terminal block	

* Technical performance data acc. to IEC 60268-5

Mechanical

Dimensions (H x W x D)	600 x 80 x 90 mm (23.62 x 3.15 x 3.54 in)
Weight	3 kg (6.6 lb)
Color	Housing: RAL 9022 Pearl light gray Grill: RAL 9006 White aluminum Top/bottom covers: RAL 7005 Mouse gray

Environmental

Operating temperature	-25 °C to +55°C (-13 °F to +131 °F)
Storage and transport temperature	-40 °C to +70 °C (-40 °F to +158 °F)
Relative humidity	<95%

Note:

- The specification data is measured in an anechoic chamber, free field
- The reference axis is perpendicular to the center point of the front grille
- The reference plane is perpendicular to the center of the reference axis
- The horizontal plane is perpendicular to the center of the reference plane

LBC 3201/00**Electrical***

Rated power	60 / 30 / 15 W<	
Sound pressure level at 60 W / 1 W (1 kHz, 1 m)	110 dB / 92 dB (SPL)	
Sound pressure level at 60 W / 1 W (1 kHz, 4 m)	92 dB / 76 dB (SPL)	
Effective frequency range (-10 dB)	190 Hz to 18 kHz	
Opening angle	1 kHz / 4 kHz (-6 dB)	
horizontal	210° / 132°	
vertical	50° / 22°	
Rated input voltage		100 V
Rated impedance	60 W	167 Ohm
	30 W	333 Ohm
	15 W	667 Ohm
Connector	Screw terminal block	

*) Technical performance data acc. to IEC 60268-5

Mechanical

Dimensions (H x W x D)	1200 x 80 x 90 mm (47.24 x 3.15 x 3.54 in)
Weight	6,4 kg (14,1 lb)
Color	Housing: RAL 9022 Pearl light gray Grill: RAL 9006 White aluminum Top/bottom covers: RAL 7005 Mouse gray

Environmental

Operating temperature	-25 °C to +55°C (-13 °F to +131 °F)
Storage and transport temperature	-40 °C to +70 °C (-40 °F to +158 °F)
Relative humidity	<95%

Note:

- The specification data is measured in an anechoic chamber, free field
- The reference axis is perpendicular to the center point of the front grille
- The reference plane is perpendicular to the center of the reference axis
- The horizontal plane is perpendicular to the center of the reference plane

LBC 3210/00**Electrical***

Rated Power	60 / 30 / 15 W	
Sound pressure level at 60 W / 1 W (1 kHz, 1 m)	115 dB / 97 dB (SPL)	
Sound pressure level at 60 W / 1 W (1 kHz, 4 m)	98 dB / 81 dB (SPL)	
Effective frequency range (-10 dB)	190 Hz to 20 kHz	
Opening angle	1 kHz / 4 kHz (-6 dB)	
horizontal	170° / 90°	
vertical	55° / 18°	
Rated input voltage		100 V
Rated impedance	60 W	167 Ohm
	30 W	333 Ohm
	15 W	667 Ohm
Connector	Screw terminal block	

* Technical performance data acc. to IEC 60268-5

Mechanical

Dimensions (H x W x D)	1200 x 160 x 90 mm (47.24 x 6.3 x 3.54 in)
Weight	9 kg (19,8 lb)
Color	Housing: RAL 9022 Pearl light gray Grill: RAL 9006 White aluminum Top/bottom covers: RAL 7005 Mouse gray

Environmental

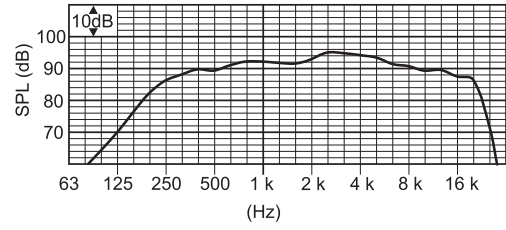
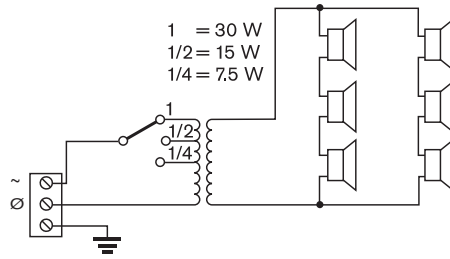
Operating temperature	-25 °C to +55°C (-13 °F to +131 °F)
Storage and transport temperature	-40 °C to +70 °C (-40 °F to +158 °F)
Relative humidity	<95%

Note:

- The specification data is measured in an anechoic chamber, free field
- The reference axis is perpendicular to the center point of the front grille
- The reference plane is perpendicular to the center of the reference axis
- The horizontal plane is perpendicular to the center of the reference plane

5.1 Additional technical data

LBC 3200/00



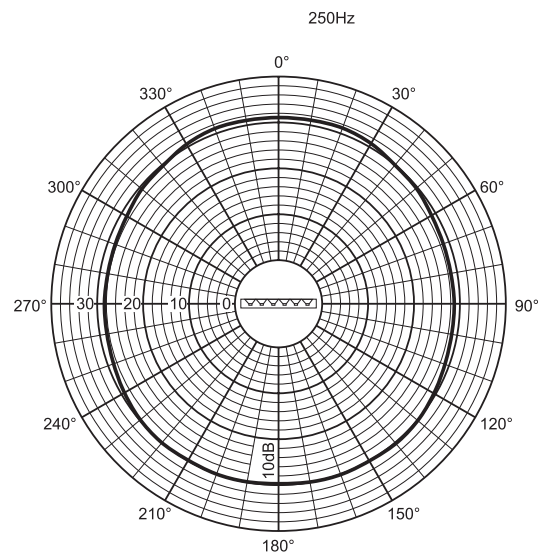
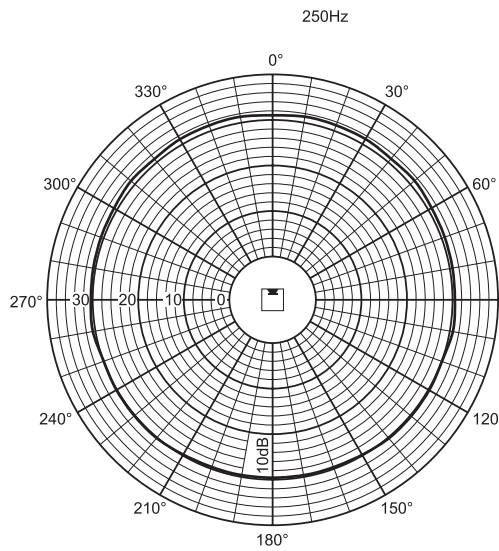
Circuit diagram

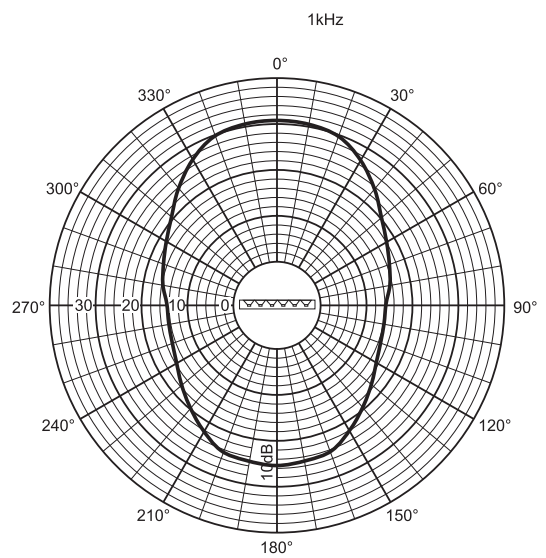
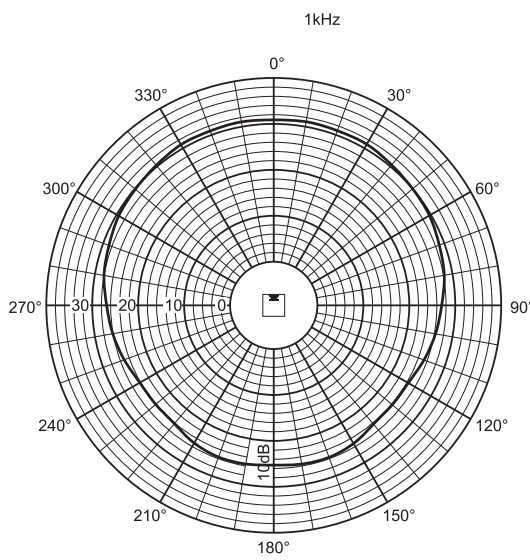
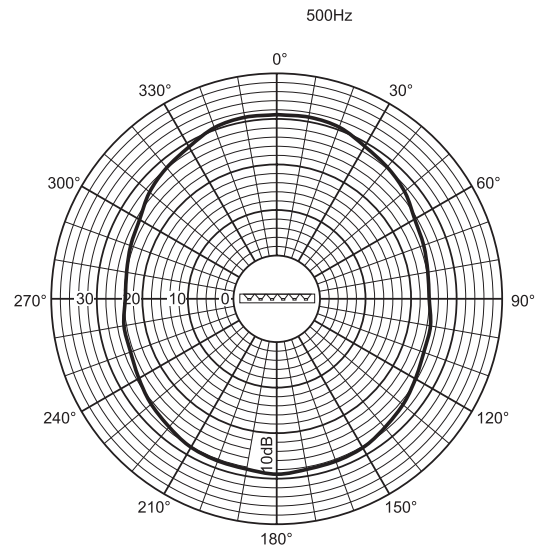
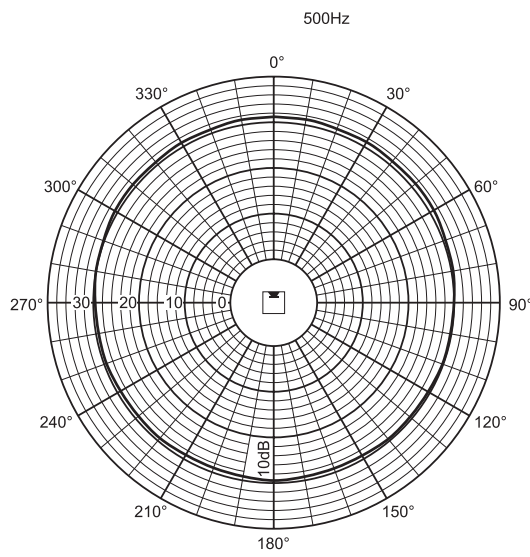
Frequency response

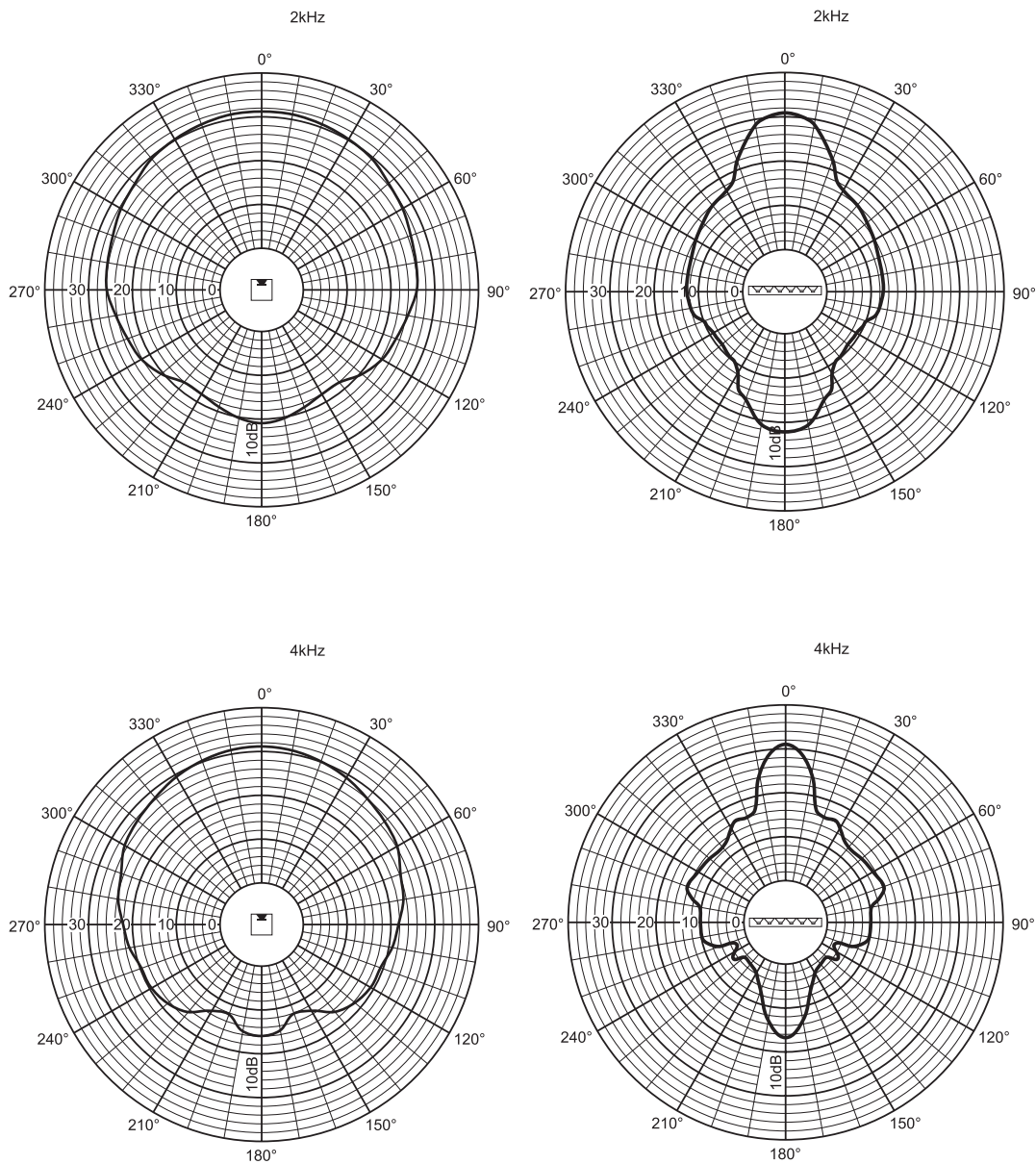
Octave band (Hz)	250	500	1 k	2 k	4 k	8 k
SPL 1.1	87	89	91	93	93	89
SPL max.	102	104	106	108	108	104
Q-factor	1.3	2.2	4.5	11.6	25.7	58.9
Hor. Angle (deg)	360	360	220	190	130	100
Vert. Angle (deg)	360	120	70	32	18	10

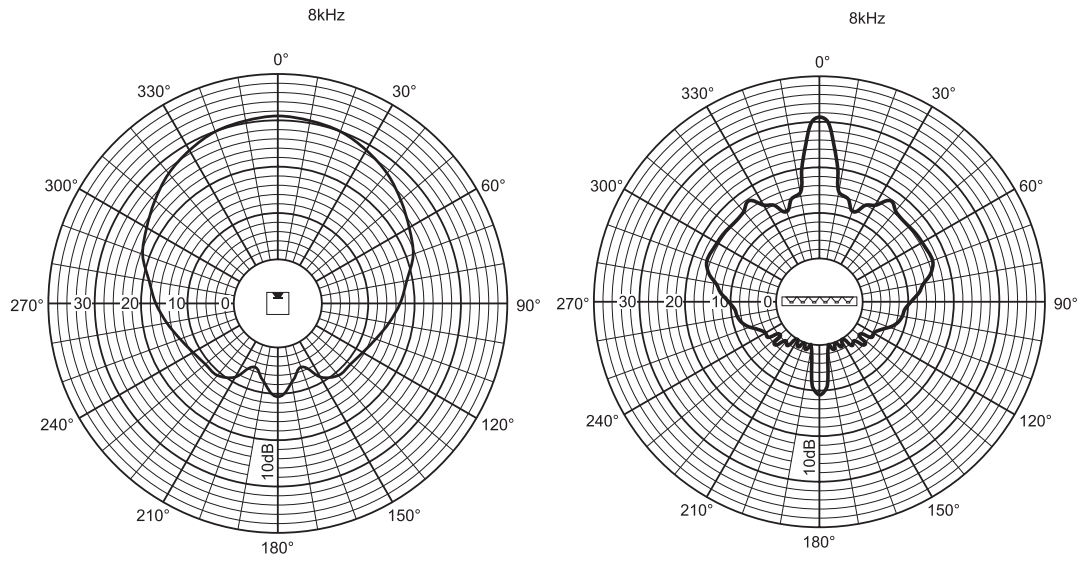
Horizontal

Vertical

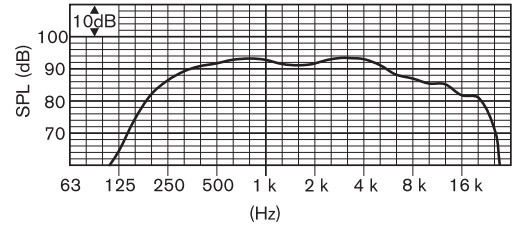
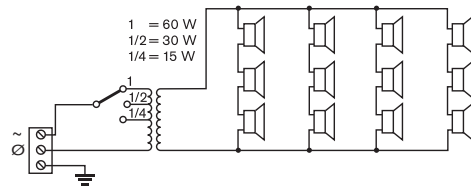








LBC 3201/00



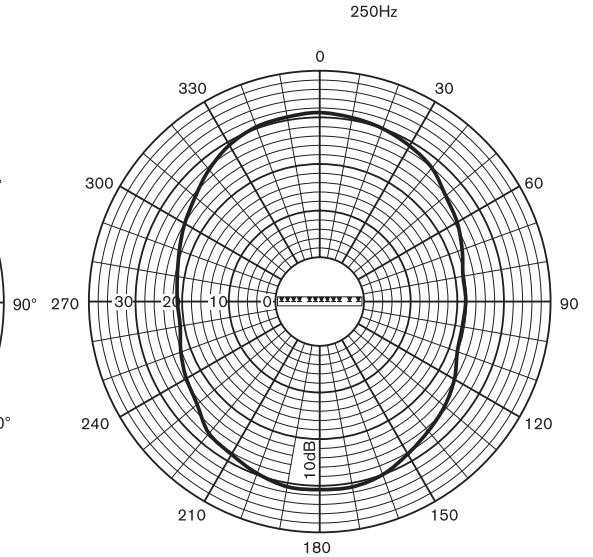
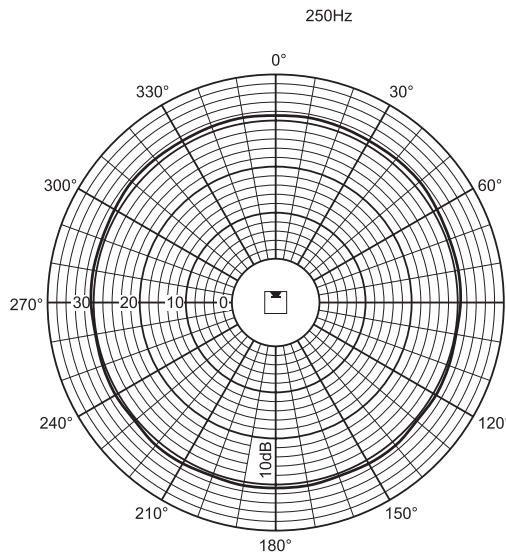
Circuit diagram

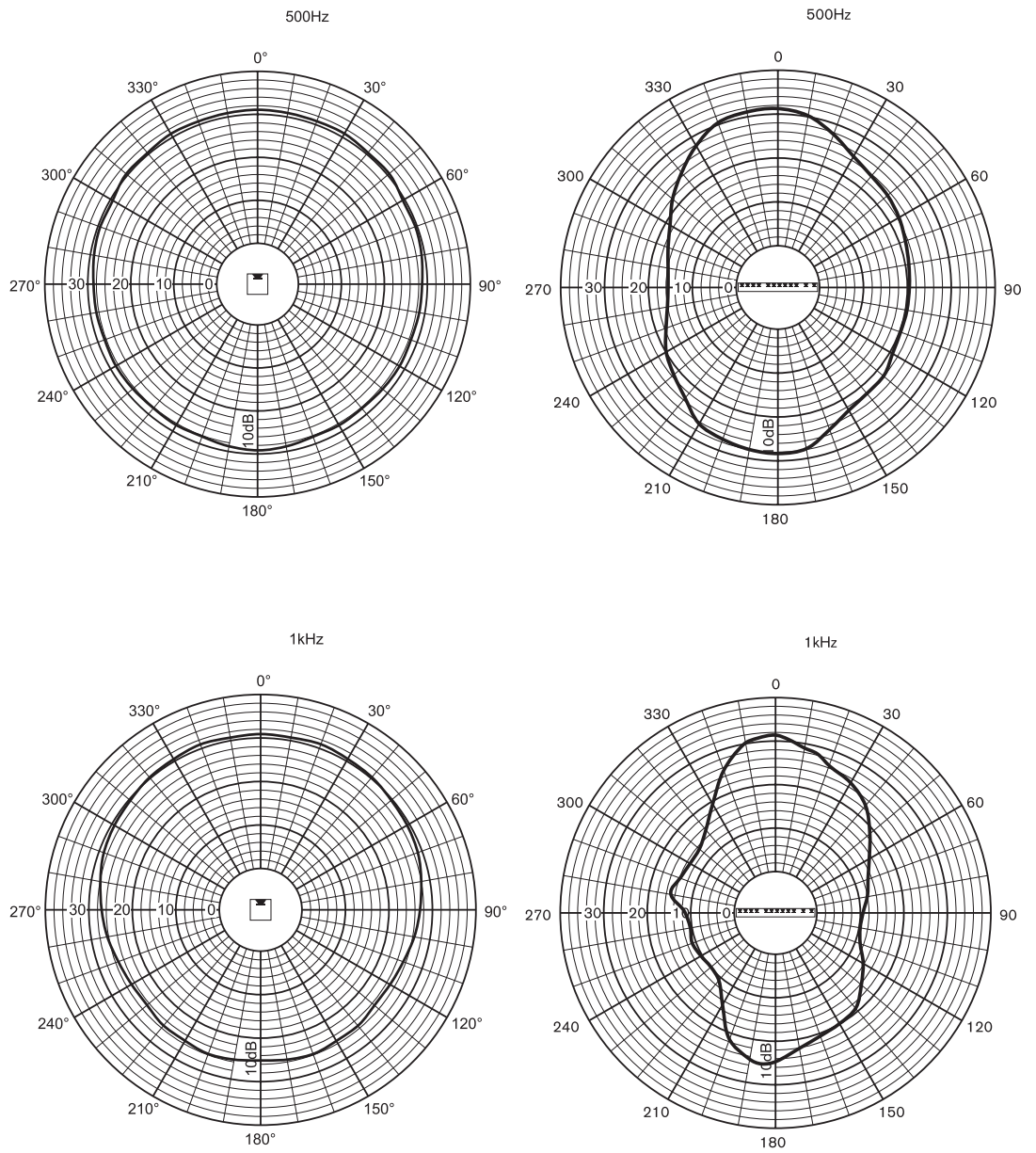
Frequency response

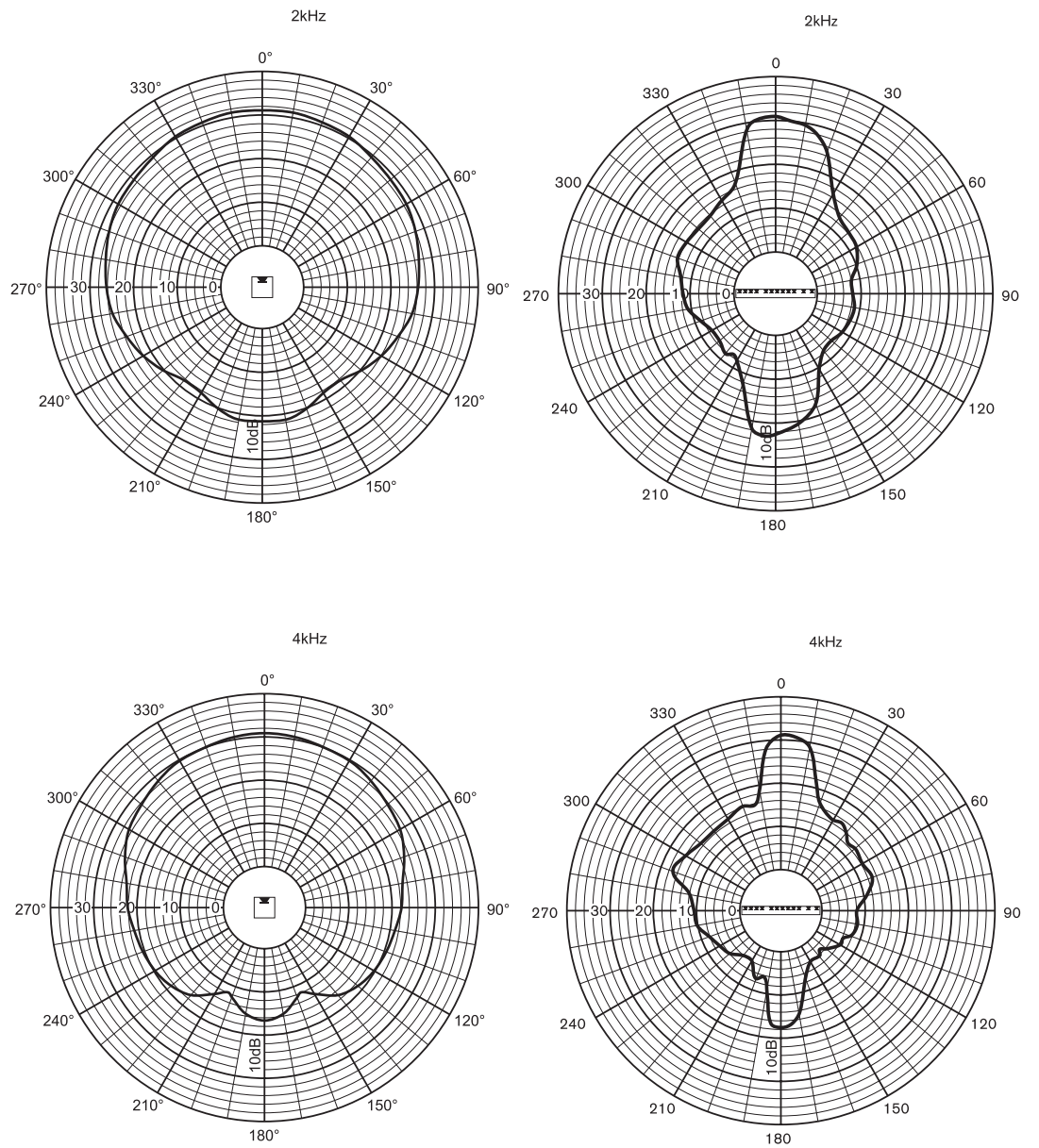
Octave band (Hz)	250	500	1 k	2 k	4 k	8 k
SPL 1.1	88	92	92	91	91	86
SPL max.	106	110	110	109	109	104
Q-factor	2.2	3.2	6.5	12.6	23.4	53.3
Hor. Angle (deg)	360	360	210	192	132	100
Vert. Angle (deg)	107	67	50	33	22	12

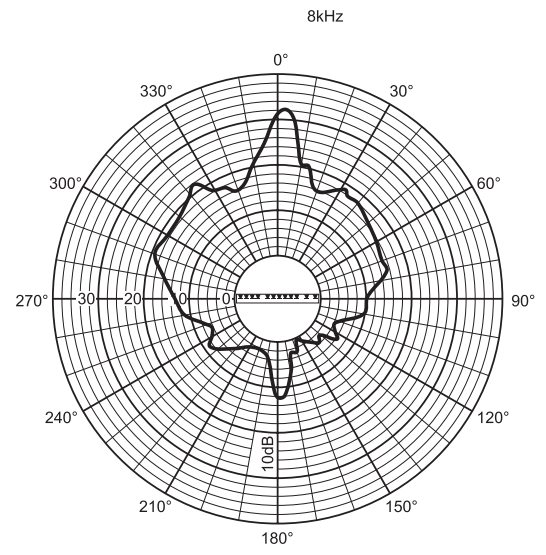
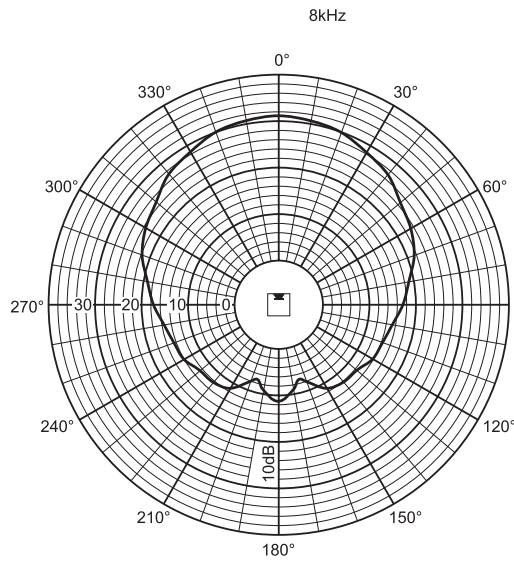
Horizontal

Vertical

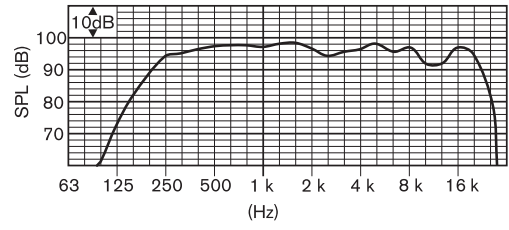
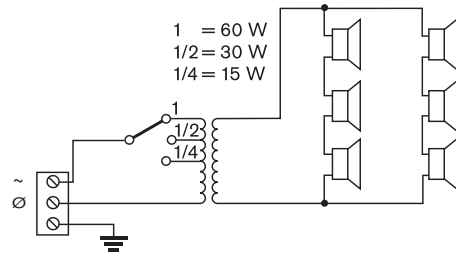








LBC 3210/00



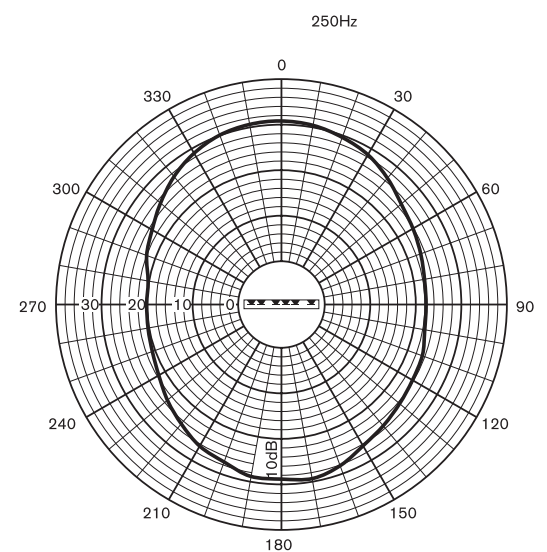
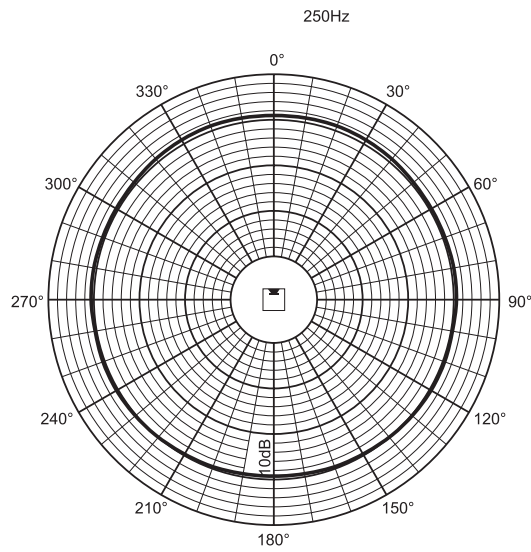
Circuit diagram

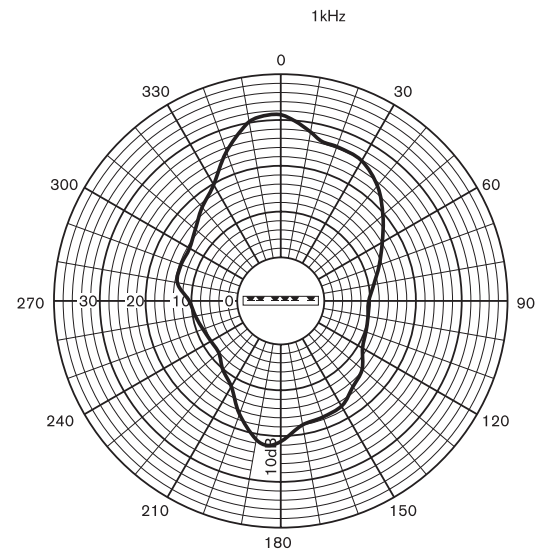
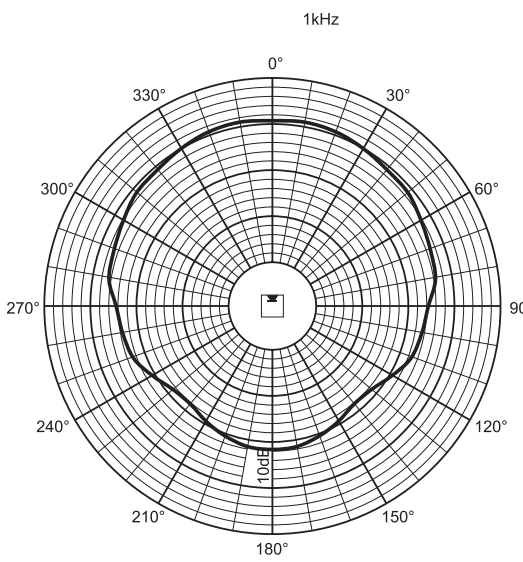
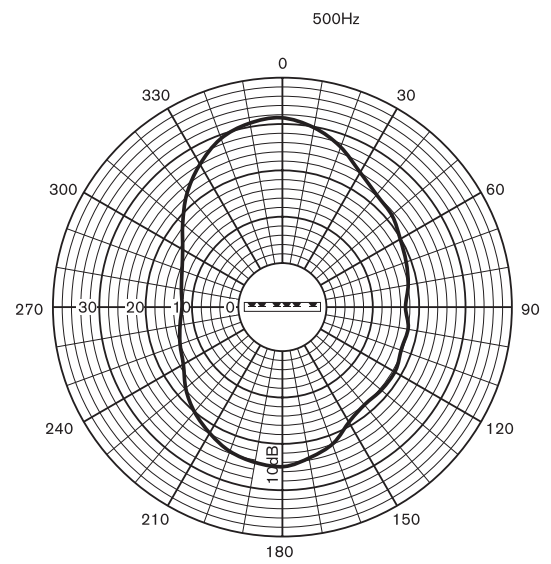
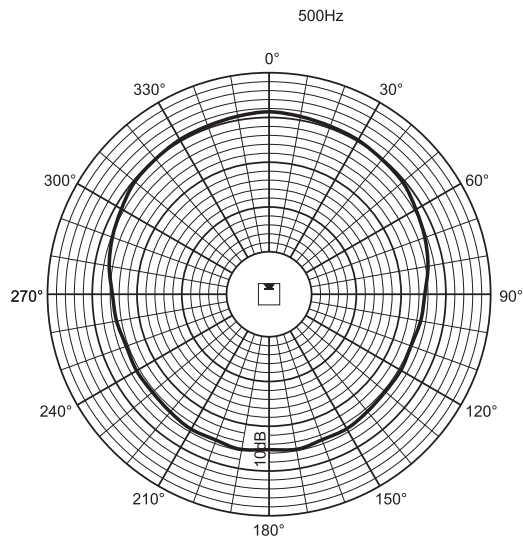
Frequency response

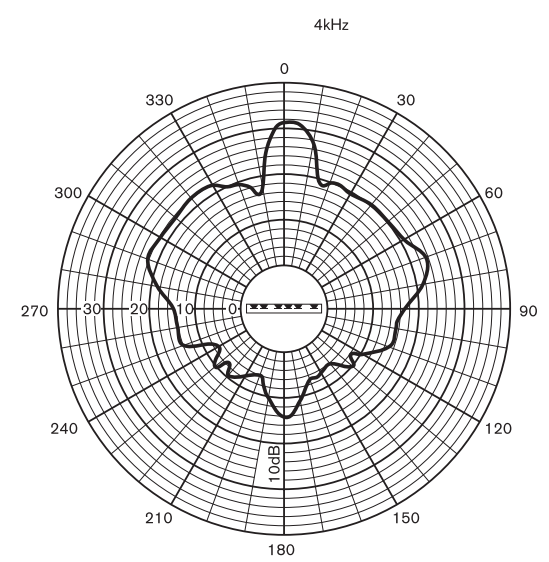
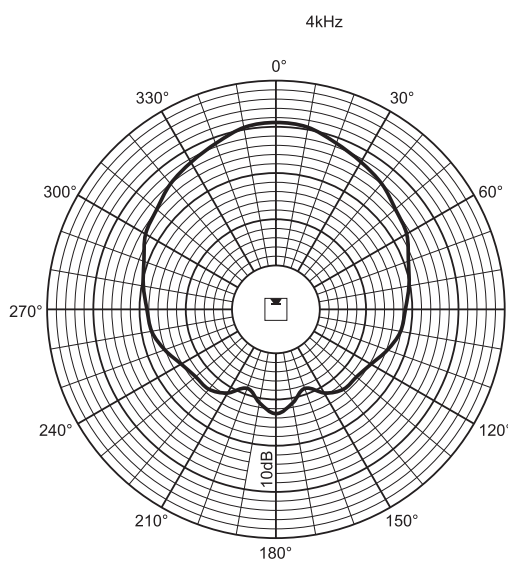
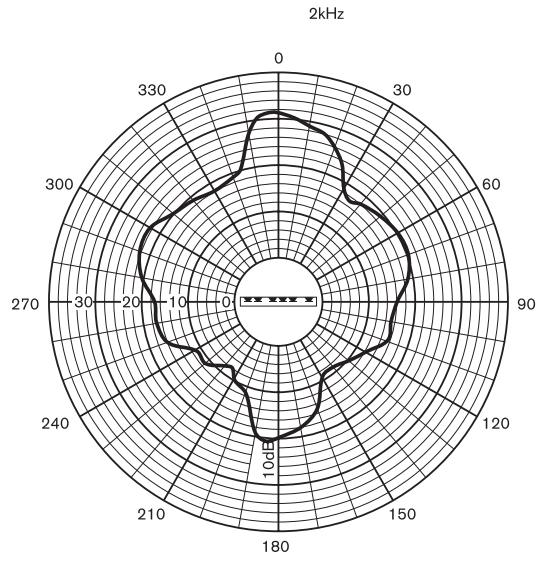
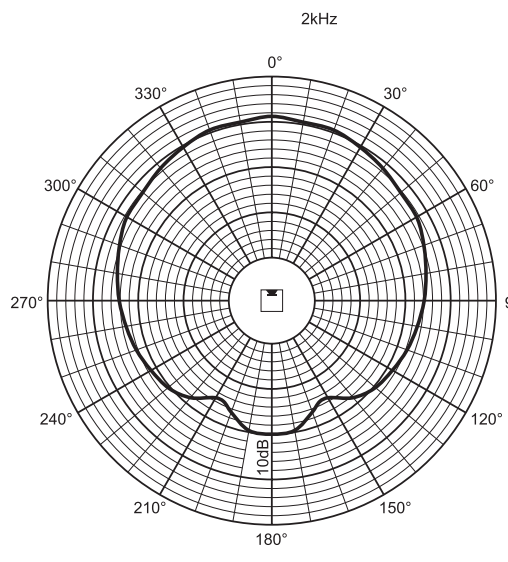
Octave band (Hz)	250	500	1 k	2 k	4 k	8 k
SPL 1.1	94	97	97	95	96	93
SPL max.	112	115	115	113	114	111
Q-factor	2.2	2.7	6.3	10.8	22.6	32.3
Hor. Angle (deg)	360	180	170	160	90	60
Vert. Angle (deg)	100	60	55	34	18	10

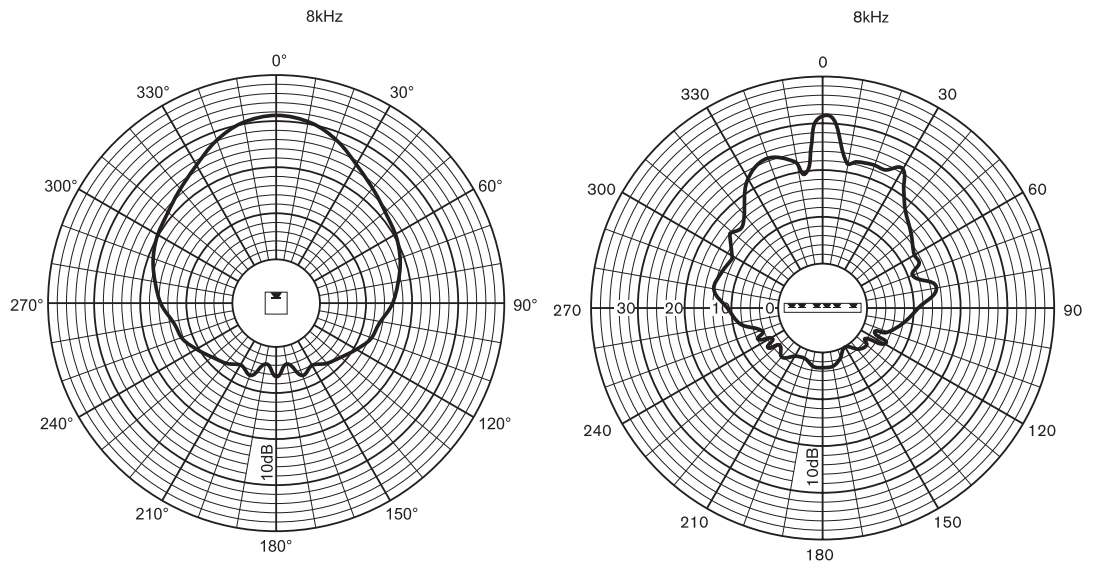
Horizontal




Vertical









 1438
Bosch Security Systems BV Torenallee 49, 5617 BA Eindhoven, the Netherlands 12 1438-CPR-0254
EN 54-24:2008 Loudspeaker for voice alarm systems for fire detection and fire alarm systems for buildings Line Array 30 W LBC3200/00 Type A DoP: LP052913
 1438
Bosch Security Systems BV Torenallee 49, 5617 BA Eindhoven, the Netherlands 12 1438-CPR-0254
EN 54-24:2008 Loudspeaker for voice alarm systems for fire detection and fire alarm systems for buildings Line Array 60 W LBC3201/00 Type A DoP: LP052913
 1438
Bosch Security Systems BV Torenallee 49, 5617 BA Eindhoven, the Netherlands 12 1438-CPR-0254
EN 54-24:2008 Loudspeaker for voice alarm systems for fire detection and fire alarm systems for buildings Line Array 60 W LBC3210/00 Type B DoP: LP052913

6 Certifications and approvals

For LBC3200/00 and LBC3201/00

Safety	according to IEC/EN 62368-1
Emergency	according to EN 54-24 according to BS 5839-8
Impact	according to EN 50102, IK 07
Water and dust protection	according to IEC/EN 60529, IP21C

For LBC3210/00

Safety	according to IEC/EN 62368-1
Emergency	according to EN 54-24 according to BS 5839-8
Impact	according to EN 50102, IK 07
Water and dust protection	according to IEC/EN 60529, IP66
Wind-force	according to Bft 11



Notice!

System installation and servicing by qualified personnel only, in accordance with applicable local codes. No user-serviceable parts inside.

Bosch Security Systems B.V.

Torenallee 49

5617 BA Eindhoven

Netherlands

www.boschsecurity.com

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