

# INTEGRUS



Security Systems

Installation and Operating Manual  
en Digital Infra-Red  
Language Distribution  
System

# BOSCH

## **Important Safeguards**

Prior to installing or operating this product always read the Safety Instructions which are available as a separate document.

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# 1 System description and planning

## 1.1 System overview

Integrus is a system for wireless distribution of audio signals via infra-red radiation. It can be used in a simultaneous interpretation system for international conferences where multiple languages are used. To enable all participants to understand the proceedings, interpreters simultaneously translate the speaker's language as required. These interpretations are distributed throughout the conference venue, and delegates select the language of their choice and listen to it through headphones. The Integrus system can also be used for music distribution (mono as well as stereo).

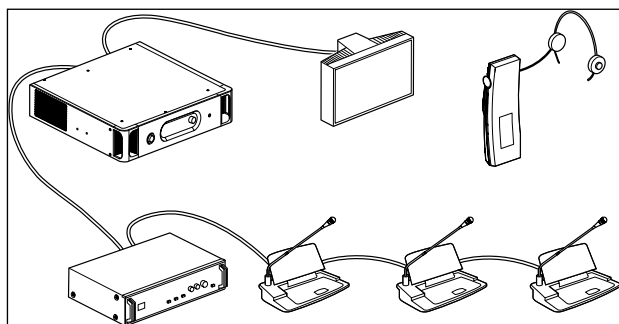


Figure 1.1 Integrus system overview (with DCN-system as input)

The Integrus Digital Infra-red Language Distribution System comprises one or more of the following:

### Infra-red transmitter

The transmitter is the core of the Integrus system. Four types are available:

- LBB 4502/04 with inputs for 4 audio channels
- LBB 4502/08 with inputs for 8 audio channels
- LBB 4502/16 with inputs for 16 audio channels
- LBB 4502/32 with inputs for 32 audio channels

### Interface modules

One of two different interface modules can be mounted in the transmitter housing to connect the transmitter to a wide range of conference systems:

- LBB 3423 DCN Interface module to connect to the Digital Congress Network (DCN).
- LBB 3422/1x Symmetrical Audio Input and Interpreters Module to connect to analogue discussion and conference systems (such as CCS 800) or to LBB 3222/04 6-channel interpreters desks.

### Infra-red radiators

Two types of radiators are available:

- LBB 4511/00 medium-power radiator for small/medium conference venues
- LBB 4512/00 high-power radiator for medium/large conference venues

Both types can be switched between full and half power use. They can be mounted on walls, ceilings or floor stands.

### Infra-red receivers

Two multi-channel infra-red receivers are available:

- LBB 4540/04 for 4 audio channels
- LBB 4540/32 for 32 audio channels

They can operate with a rechargeable NiMH battery pack or with disposable batteries. Charging circuitry is incorporated in the receiver.

### Charging equipment

Equipment is available for charging and storing 56 infra-red receivers. It is available for portable or fixed-installation applications.

## 1.2 System technology

### 1.2.1 IR radiation

The Integrus system is based on transmission by modulated infra-red radiation. Infra-red radiation forms part of the electro-magnetic spectrum, which is composed of visible light, radio waves and other types of radiation. It has a wavelength just above that of visible light. Like visible light, it is reflected from hard surfaces, yet passes through translucent materials such as glass. The infra-red radiation spectrum in relation to other relevant spectra is shown in figure 1.2.

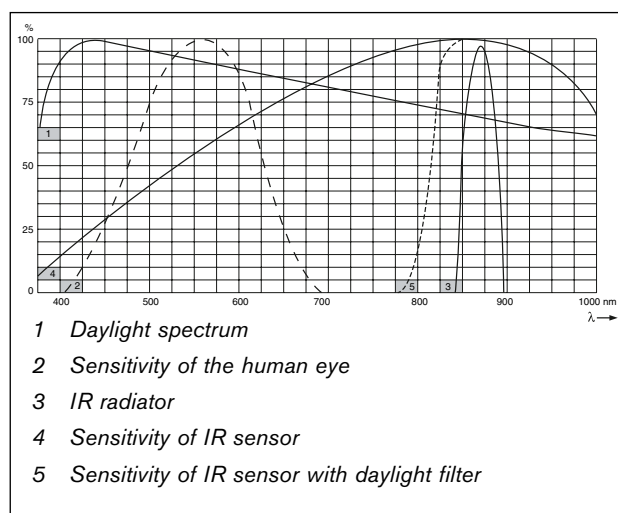


Figure 1.2 Infra-red radiation spectrum in relation to other spectra

### 1.2.2 Signal Processing

The Integrus system uses high frequency carrier signals (typically 2-8 MHz) to prevent interference problems with modern light sources (see section 1.3.2). The digital audio processing guarantees a constant high audio quality.

The signal processing in the transmitter consists of the following main steps (see figure 1.3):

1. **A/D conversion** - Each analogue audio channel is converted to a digital signal.
2. **Compression** - The digital signals are compressed to increase the amount of information that can be distributed on each carrier. The compression factor is also related to the required audio quality.
3. **Protocol Creation** - Groups of up to four digital signals are combined into a digital information stream. Extra fault algorithm information is added. This information is used by the receivers for fault detection and correction.
4. **Modulation** - A high frequency carrier signal is phase-modulated with the digital information stream.
5. **Radiation** - Up to 8 modulated carrier signals are combined and sent to the IR radiators, which convert the carrier signals to modulated infra-red light.

In the IR receivers a reverse processing is used to convert the modulated infra-red light to separate analogue audio channels.

### 1.2.3 Quality modes

The Integrus system can transmit audio in four different quality modes:

- Mono, standard quality, maximum 32 channels
- Mono, premium quality, maximum 16 channels
- Stereo, standard quality, maximum 16 channels
- Stereo, premium quality, maximum 8 channels

The standard quality mode uses less bandwidth and can be used for transmitting speech. For music the premium quality mode gives near CD quality.

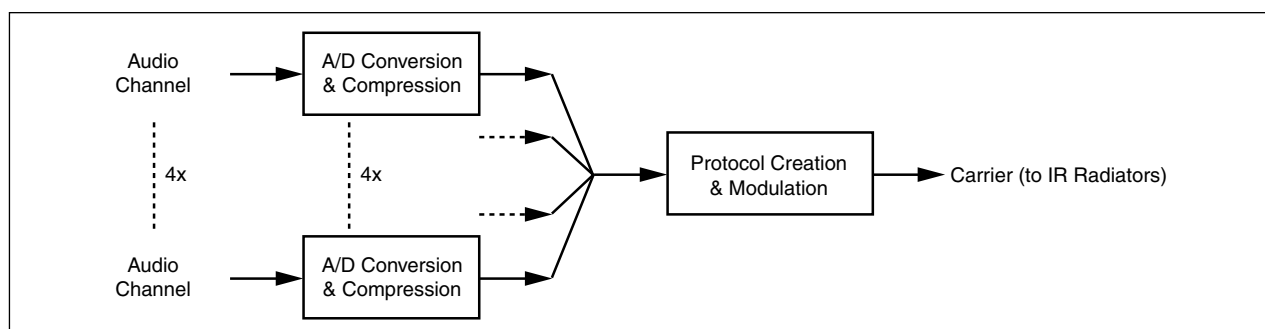


Figure 1.3 Overview of the signal processing (for one carrier)

### 1.2.4 Carriers and channels

The Integrus system can transmit up to 8 different carrier signals (depending on the transmitter type). Each carrier can contain up to 4 different audio channels.

The maximum number of channels per carrier is dependent on the selected quality modes. Stereo signals use twice as much bandwidth as a mono signals, premium quality uses twice as much bandwidth as standard quality.

Per carrier a mix of channels with different quality modes is possible, as long as the total available bandwidth is not exceeded. The table below lists all possible channel combinations per carrier:

|                                         | Channel quality |              |                 |                | Bandwidth                                               |
|-----------------------------------------|-----------------|--------------|-----------------|----------------|---------------------------------------------------------|
|                                         | Mono Standard   | Mono Premium | Stereo Standard | Stereo Premium |                                                         |
|                                         | 4               |              |                 |                |                                                         |
| Possible number of channels per carrier | 2               | 1            |                 |                | 2 x 10 kHz and 1 x 20 kHz                               |
|                                         | 2               |              | 1               |                | 2 x 10 kHz and 1 x 10 kHz (left) and 1 x 10 kHz (right) |
|                                         |                 | 1            | 1               |                | 1 x 20 kHz and 1 x 10 kHz (left) and 1 x 10 kHz (right) |
|                                         |                 |              | 2               |                | 2 x 10 kHz (left) and 2 x 10 kHz (right)                |
|                                         |                 | 2            |                 |                | 2 x 20 kHz                                              |
|                                         |                 |              |                 | 1              | 1 x 20 kHz (left) and 1 x 20 kHz (right)                |
|                                         |                 |              |                 |                |                                                         |

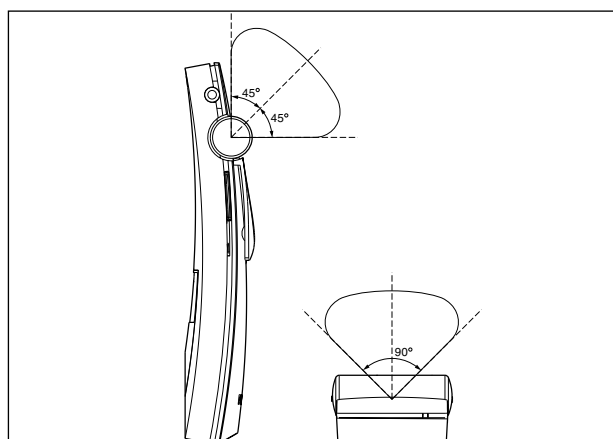


Figure 1.4 Directional characteristics of the receivers

## 1.3 Aspects of infra-red distribution systems

A good infra-red distribution system ensures that all delegates in a conference venue receive the distributed signals without disturbance. This is achieved by using enough radiators, placed at well planned positions, so that the conference venue is covered with uniform IR-radiation of adequate strength.

There are several aspects that influence the uniformity and quality of the infra-red signal, which must be considered when planning an infra-red radiation distribution system. These are discussed in the next sections.

### 1.3.1 Directional sensitivity of the receiver

The sensitivity of a receiver is at its best when it is aimed directly towards a radiator. The axis of maximum sensitivity is tilted upwards at an angle of 45 degrees (see figure 1.4). Rotating the receiver will decrease the sensitivity. For rotations of less than +/- 45 degrees this effect is not large, but for larger rotations the sensitivity will decrease rapidly.

### 1.3.2 The footprint of the radiator

The coverage area of a radiator depends on the number of transmitted carriers and the output power of the radiator. The coverage area of the LBB 4512 radiator is twice as large as the coverage area of the LBB 4511.

The coverage area can also be doubled by mounting two radiators side by side. The total radiation energy of a radiator is distributed over the transmitted carriers. When more carriers are used, the coverage area gets proportionally smaller. The receiver requires a strength of the IR signal of 4 mW/m<sup>2</sup> per carrier to work without errors (resulting in a 80 dB S/N ratio for the audio channels). The effect of the number of carriers on the coverage area can be seen in figure 1.5 and figure 1.6. The radiation pattern is the area within which the radiation intensity is at least the minimum required signal strength.

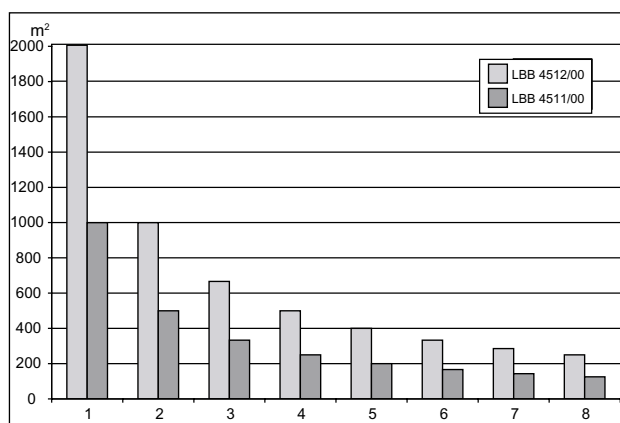


Figure 1.5 Total coverage area of LBB 4511/00 and LBB 4512/00 for 1 to 8 carriers

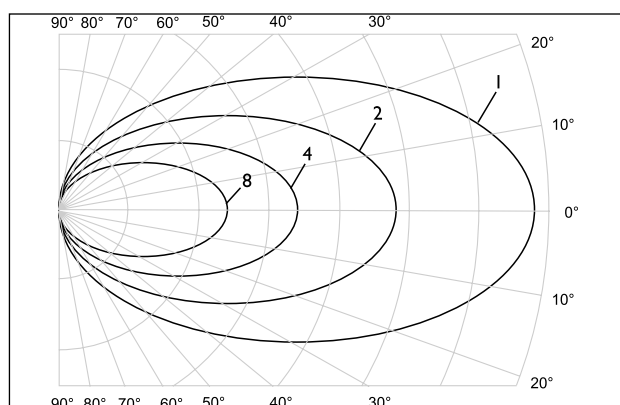


Figure 1.6 Polar diagram of the radiation pattern for 1, 2, 4 and 8 carriers

The cross section of the 3-dimensional radiation pattern with the floor of the conference venue is known as the footprint (the white area in figure 1.7 to figure 1.9). This is the floor area in which the direct signal is strong enough to ensure proper reception, when the receiver is directed towards the radiator. As shown, the size and position of the footprint depends on the mounting height and angle of the radiator.

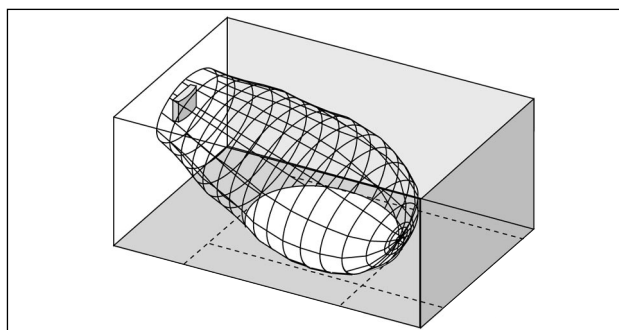


Figure 1.7 The radiator mounted at 15° to the ceiling

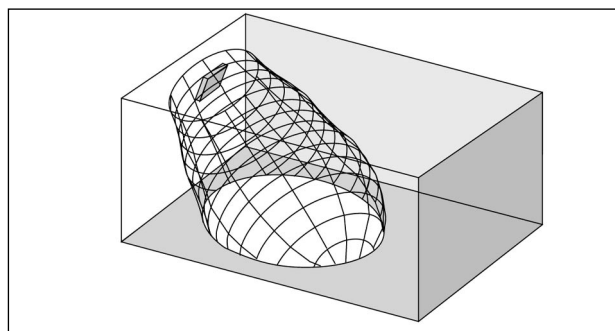


Figure 1.8 The radiator mounted at 45° to the ceiling

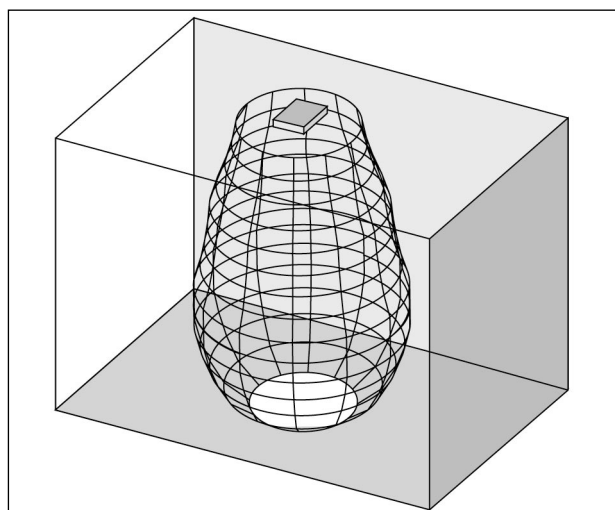


Figure 1.9 The radiator mounted perpendicular (at 90°) to the ceiling

### 1.3.3 Ambient lighting

The Integrus system is practically immune for the effect of ambient lighting. Fluorescent lamps (with or without electronic ballast or dimming facility), such as TL lamps or energy saving lamps give no problems with the Integrus system. Also sunlight and artificial lighting with incandescent or halogen lamps up to 1000 lux give no problems with the Integrus system. When high levels of artificial lighting with incandescent or halogen lamps, such as spotlights or stage lighting are applied, you should directly point a radiator at the receivers in order to ensure reliable transmission. For venues containing large, unscreened windows, you must plan on using additional radiators. For events taking place in the open air a site test will be required in order to determine the required amount of radiators. With sufficient radiators installed, the receivers will work without errors, even in bright sunlight.

### 1.3.4 Objects, surfaces and reflections

The presence of objects in a conference venue can influence the distribution of infra-red light. The texture and colour of the objects, walls and ceilings also plays an important role.

Infra-red radiation is reflected from almost all surfaces. As is the case with visible light, smooth, bright or shiny surfaces reflect well. Dark or rough surfaces absorb large proportions of the infra-red signal (see figure 1.10). With few exceptions it cannot pass through materials that are opaque to visible light.

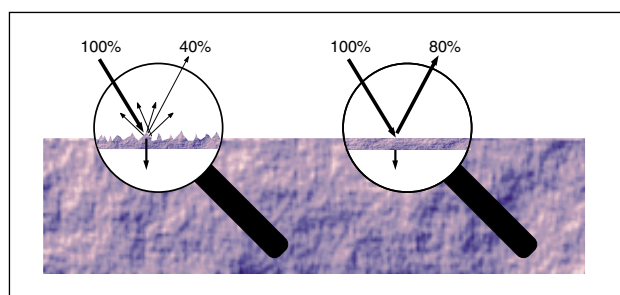


Figure 1.10 The texture of the material determines how much light is reflected and how much is absorbed

Problems caused by shadows from walls or furniture can be solved by ensuring that there are sufficient radiators and that they are well positioned, so that a strong enough infra-red field is produced over the whole conference area. Care should be taken not to direct radiators towards uncovered windows, as most of this radiation will subsequently be lost.

### 1.3.5 Positioning the radiators

Since infra-red radiation can reach a receiver directly and/or via diffused reflections, it is important to take this into account when considering the positioning of the radiators. Though it is best if receivers pick up direct path infra-red radiation, reflections improve the signal reception and should therefore not be minimised. Radiators should be positioned high enough not to be blocked by people in the hall (see figure 1.11 and figure 1.12).

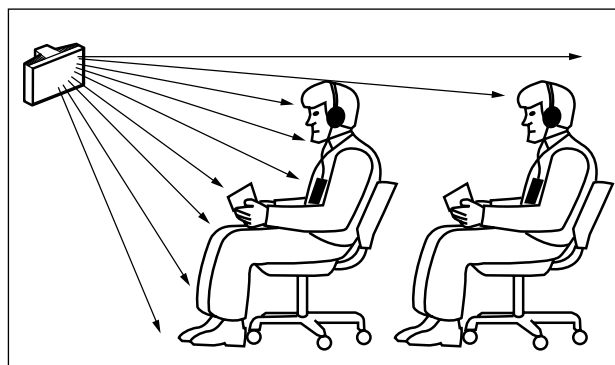


Figure 1.11 Infra-red signal blocked by a person in front of the participant

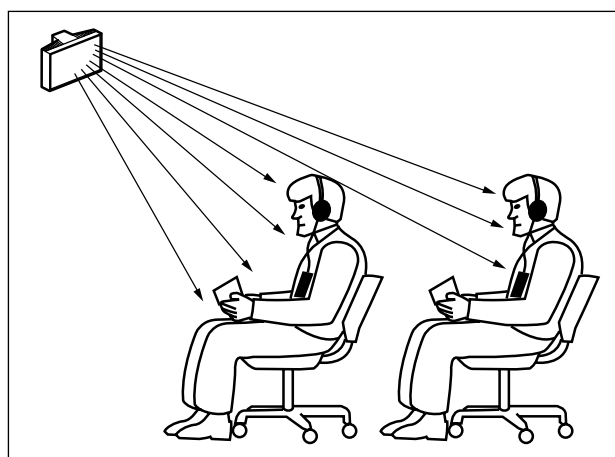


Figure 1.12 Infra-red signal not blocked by a person in front of the participant

The figures below illustrate how infra-red radiation can be directed to conference participants. In figure 1.14, the participant is situated clear from obstacles and walls, so a combination of direct and diffused radiation can be received. figure 1.13 shows the signal being reflected from a number of surfaces to the participant.

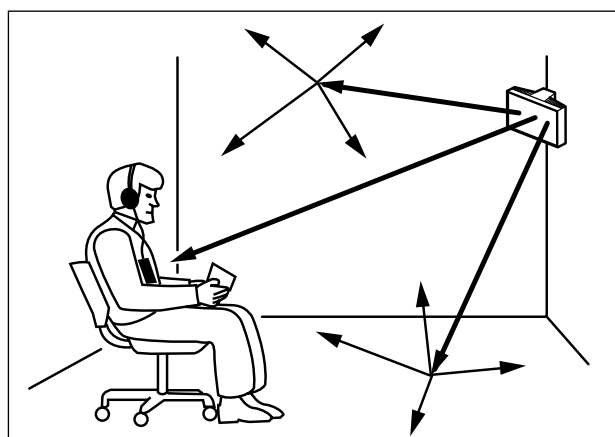


Figure 1.13 Combination of direct and reflected radiation

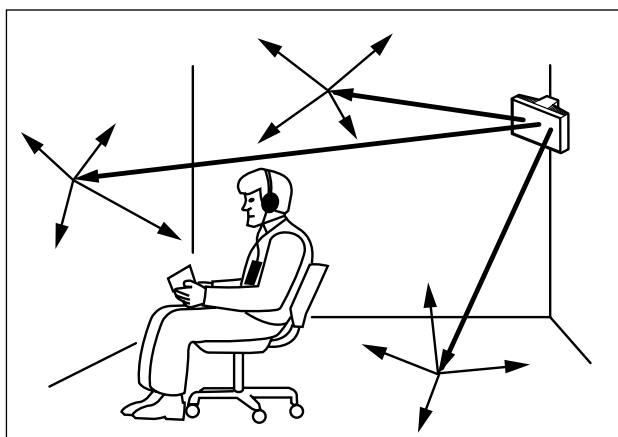


Figure 1.14 Combination of several reflected signals

For concentrically arranged conference rooms, centrally placed, angled radiators located high up can cover the area very efficiently. In rooms with few or no reflecting surfaces, such as a darkened film-projection room, the audience should be covered by direct path infra-red radiation from radiators positioned in front. When the direction of the receiver changes, e.g. with varying seat arrangements, mount the radiators in the corners of the room (see figure 1.15).

If the audience is always directed towards the radiators, you do not need radiators at the back (see figure 1.16).

If the path of the infra-red signals is partially blocked, e.g. under balconies, you should cover the 'shaded' area with an additional radiator (see figure 1.17).

The figures below illustrate the positioning of the radiators:

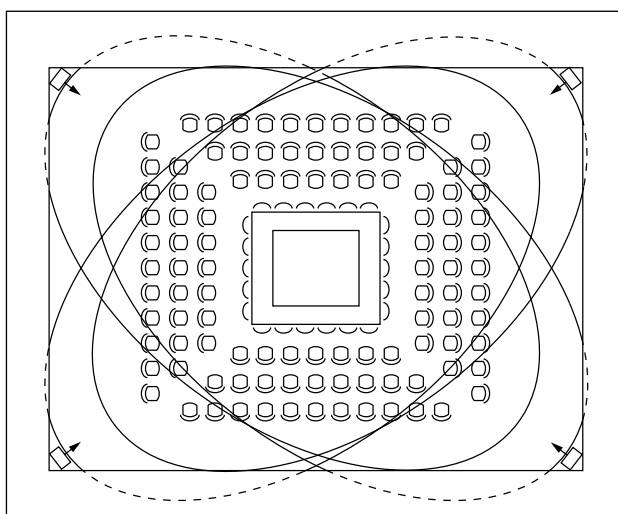


Figure 1.15 Radiator position for covering seats in a square arrangement

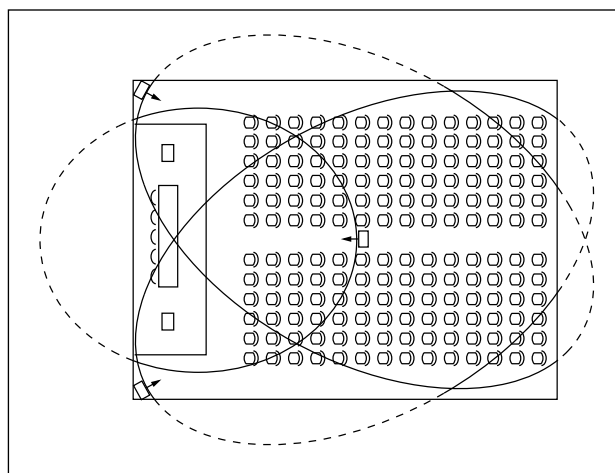


Figure 1.16 Radiator positioning in a conference hall with auditorium seating and podium

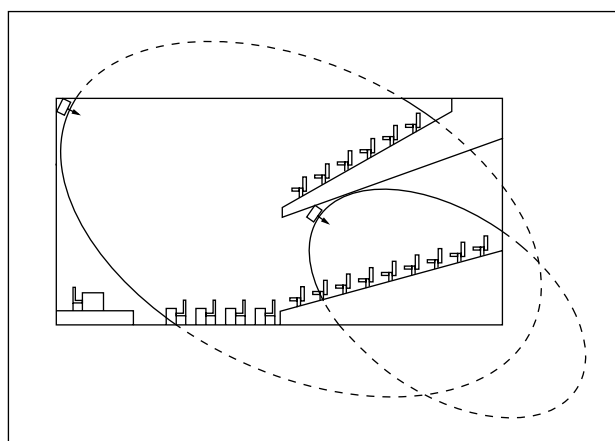


Figure 1.17 Radiator for covering seats beneath a balcony

### 1.3.6 Overlapping footprints and multipath effects

When the footprints of two radiators partly overlap, the total coverage area can be larger than the sum of the two separate footprints. In the overlap area the signal radiation power of two radiators are added, which increases the area where the radiation intensity is larger than the required intensity.

However, differences in the delays of the signals picked up by the receiver from two or more radiators can result in that the signals cancel each other out (multi path effect). In worst-case situations this can lead to a loss of reception at such positions (black spots).

Figure 1.18 and figure 1.19 illustrate the effect of overlapping footprints and differences in signal delays.

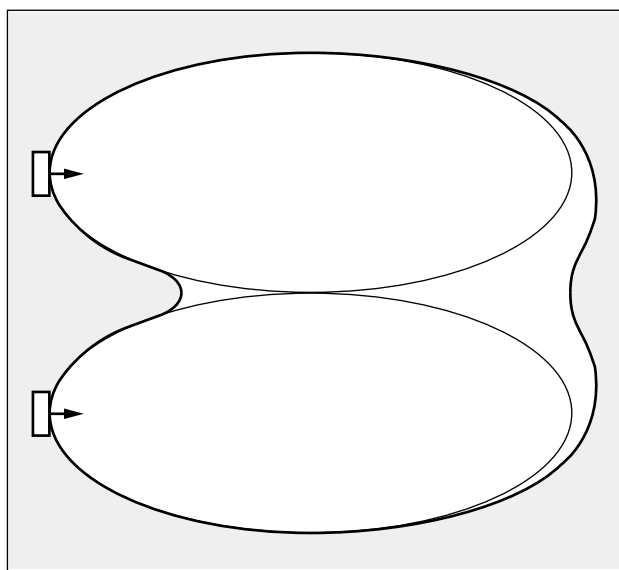


Figure 1.18 Increased coverage area caused by added radiation power

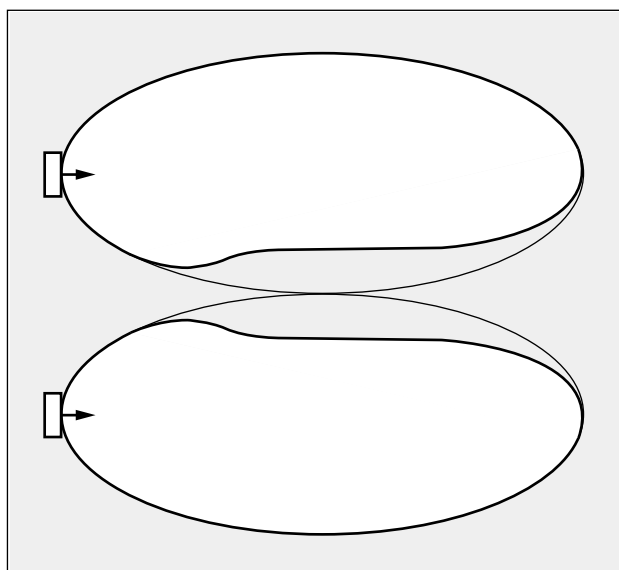


Figure 1.19 Reduced coverage area caused by differences in cable signal delay

The lower the carrier frequency, the less susceptible the receiver is for differences in signal delays. The signal delays can be compensated by using the delay compensation switches on the radiators (see section 1.5).

## 1.4 Planning an Integrus infra-red radiation system

### 1.4.1 Rectangular footprints

Determining the optimal number of infra-red radiators required to give 100% coverage of a hall can normally only be done by performing a site test. However, a good estimation can be made by using 'guaranteed rectangular footprints'. figure 1.20 and figure 1.21 show what is meant by a rectangular footprint. As can be seen, the rectangular footprint is smaller than the total footprint. Note that in figure 1.21 the 'offset' X is negative because the radiator is actually mounted beyond the horizontal point at which the rectangular footprint starts.

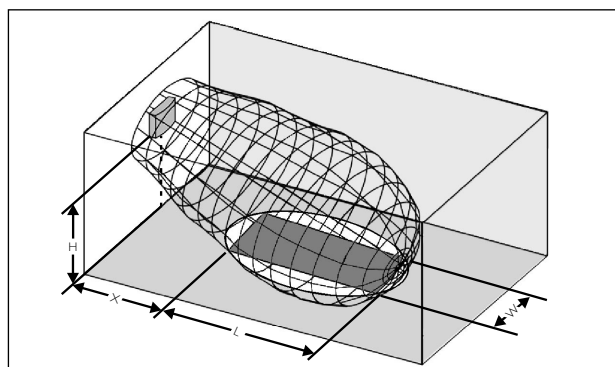


Figure 1.20 A typical rectangular footprint for a mounting angle of 15°

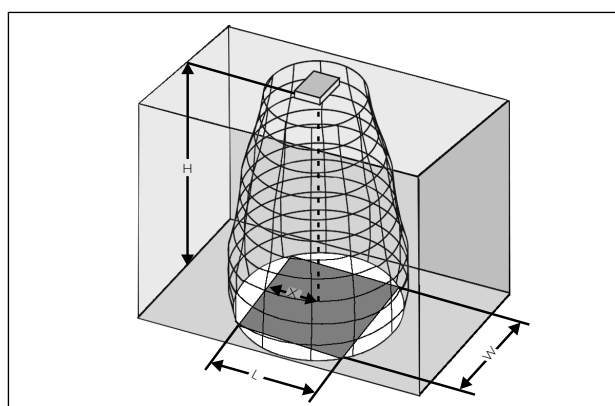


Figure 1.21 A typical rectangular footprint for a mounting angle of 90°

The guaranteed rectangular footprints for various number of carriers, mounting heights and mounting angles can be found in section 7.6. The height is the distance from the reception plane and not from the floor.

Guaranteed rectangular footprints can also be calculated with the footprint calculation tool (available on the documentation CD-ROM). The given values are for one radiator only, and therefore do not take into consideration the beneficial effects of overlapping footprints. The beneficial effects of reflections are also not included.

As rule of thumb can be given for systems with up to 4 carriers, that if the receiver can pick up the signal of two adjacent radiators the distance between these radiators can be increased by a factor 1.4 approximately (see figure 1.22).

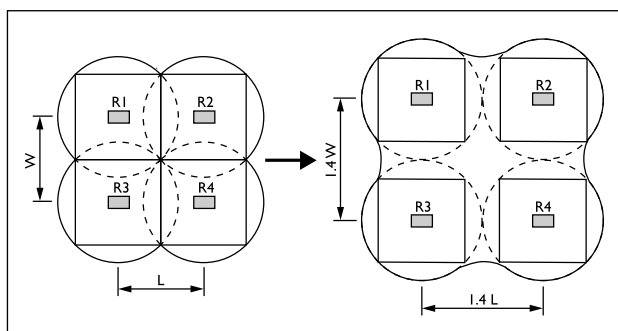


Figure 1.22 The effect of overlapping footprints

### 1.4.2 Planning radiators

Use the following procedure to plan the radiators:

1. Follow the recommendations in section 1.3 in order to determine the positioning of the radiators.
2. Look up (in the table) or calculate (with the footprint calculation tool) the applicable rectangular footprints.
3. Draw the rectangular footprints in the lay-out of the room.
4. If the receiver can pick up the signal of two adjacent radiators in some areas, determine the overlap effect and draw the footprint enlargement(s) in the lay-out of the room.
5. Check whether you have sufficient coverage with the radiators at the intended positions.
6. If not so, add additional radiators to the room.

See figure 1.15, figure 1.16 and figure 1.17 for examples of a radiator lay out.

### 1.4.3 Cabling

Signal delay differences can occur due to differences in the cable length from the transmitter to each radiator.

In order to minimize the risk of black spots, use equal cable length from transmitter to radiator if possible (see figure 1.23).

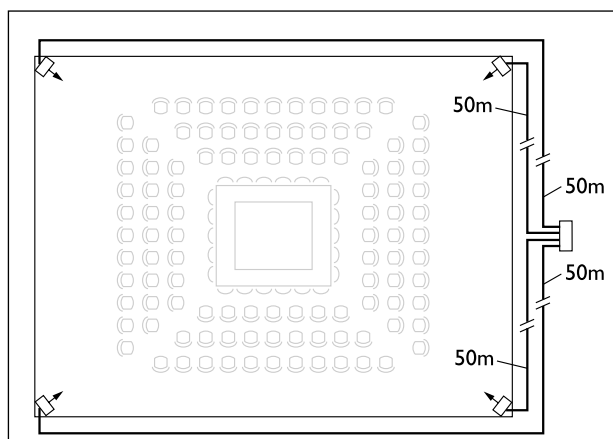


Figure 1.23 Radiators with equal cable length

When radiators are loop-through connected, the cabling between each radiator and the transmitter should be as symmetrical as possible (see figure 1.24 and figure 1.25). The differences in cable signal delays can be compensated with the signal delay compensation switches on the radiators.

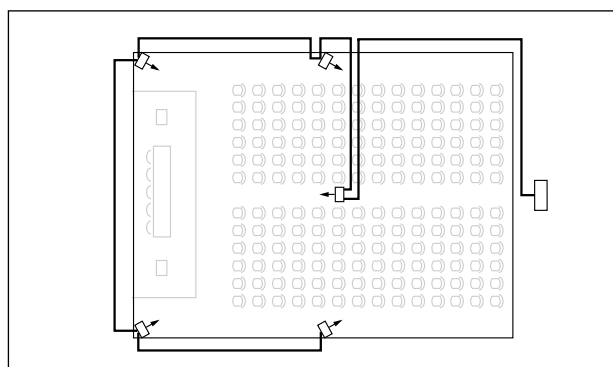


Figure 1.24 Asymmetrical arrangement of radiator cabling (to be avoided)

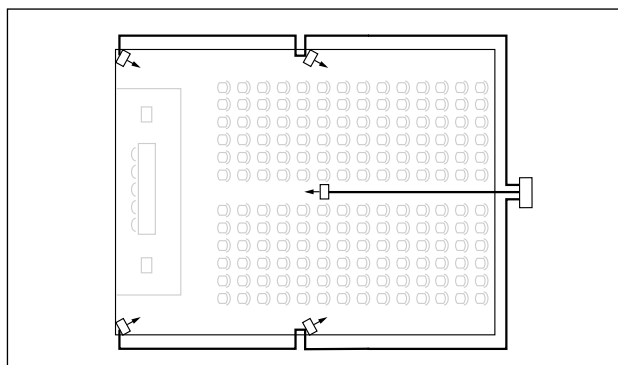


Figure 1.25 Symmetrical arrangement of radiator cabling (recommended)

## 1.5 Setting the radiator delay switches

As described in section 1.3.6, differences in the delays of the signals picked up by the receiver from two or more radiators can cause black spots as a result of the multi path effect.

The signals picked up by the receiver are delayed by:

- the transmission from transmitter to radiator through the cable (cable signal delay)
- the transmission from radiator to receiver through the air (radiation signal delay)
- for systems with two or more transmitters: the transmission through the slave transmitter(s)

To compensate the signal delay differences, the delay of each radiator can be increased. These signal delays can be set with the delay switches at the back of the radiator.

The cable signal delays can be determined in the following two ways:

- by measuring the cable lengths
- by measuring the impulse response time with a delay measurement tool

In both cases the cable signal delays can be calculated manually and with the delay switch calculation tool (available on the documentation CD-ROM).

For systems with one transmitter and radiators directly connected to the transmitter with equal cable lengths, it is not necessary to calculate the cable signal delays.

In that case set the delay switches on all radiators to zero and determine whether to compensate for radiation signal delay (see section 1.5.3).

The next sections describe how to calculate the delay switch positions manually for systems with one transmitter, or two or more transmitters. See the delay switch calculation tool for the procedures how to calculate the delay switch positions automatically.



**Tip:** The delay switch calculation tool eases the calculation of the delay switch positions.

### 1.5.1 System with one transmitter

#### 1.5.1.1 Determining delay switch positions by measuring the cable lengths

Use the following procedure to determine the delay switch position based on cable lengths:

1. Look up the cable signal delay per meter of the used cable. The manufacturer specifies this factor.
2. Measure the lengths of the cables between the transmitter and each radiator.
3. Multiply the lengths of the cables between the transmitter and each radiator with the cable signal delay per meter. These are the cable signal delays for each radiator.
4. Determine the maximum signal delay.
5. Calculate for each radiator the signal delay difference with the maximum signal delay.
6. Divide the signal delay difference by 33. The rounded off figure is the signal delay switch position for that radiator.
7. Add delay switch positions for radiators under a balcony, if applicable (see section 1.5.3).
8. Set the delay switches to the calculated switch positions.



**Caution:** Turn the delay switches carefully to a new position until you feel that it clicks into position, to prevent that a switch is positioned between two numbers, which would result in a wrong delay setting.



**Note:** For systems with a cable length difference of more than 50 meters, it is recommended to use a measurement tool to determine the delay differences in order to calculate the delay switch positions.

Figure 1.26 and table 1.1 illustrate the calculation of the cable signal delay.

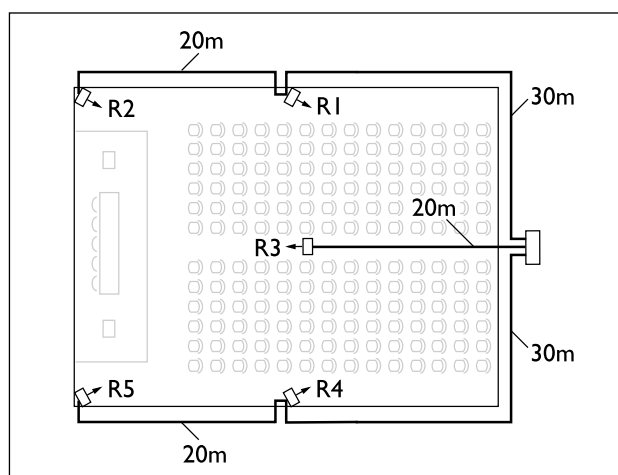


Figure 1.26 System with five radiators and measured cable lengths

Table 1.1 Calculation of the cable signal delays

| Radiator number | Total cable length [m] | Cable signal delay per meter [ns/m] | Cable signal delay [ns] | Signal delay difference [ns] | Delay switch position |
|-----------------|------------------------|-------------------------------------|-------------------------|------------------------------|-----------------------|
| 1               | 30                     | 5.6                                 | $30 \times 5.6 = 168$   | $280 - 168 = 112$            | $112/33 = 3.39 = 3$   |
| 2               | $30 + 20 = 50$         | 5.6                                 | $50 \times 5.6 = 280$   | $280 - 280 = 0$              | $0/33 = 0$            |
| 3               | 20                     | 5.6                                 | $20 \times 5.6 = 112$   | $280 - 112 = 168$            | $168/33 = 5.09 = 5$   |
| 4               | 30                     | 5.6                                 | $30 \times 5.6 = 168$   | $280 - 168 = 112$            | $112/33 = 3.39 = 3$   |
| 5               | $30 + 20 = 50$         | 5.6                                 | $50 \times 5.6 = 280$   | $280 - 280 = 0$              | $0/33 = 0$            |



**Note:** The used cable signal delay per meter is an example. Use the actual signal delay per meter in this calculation as specified by the manufacturer.

### 1.5.1.2 Determining delay switch positions by using a delay measuring tool

The most accurate way to determine the cable signal delays is to measure the actual signal delay for each radiator as described in the following procedure:

1. Disconnect the cable from a radiator output of the transmitter and connect this to a delay measurement tool.
2. Disconnect a radiator from this cable.
3. Measure the impulse response time (in ns) of the cable(s) between the transmitter and the radiator.
4. Reconnect the cable to the radiator and repeat steps 2 to 4 for the other radiators that are connected to the same transmitter output.
5. Reconnect the cable to the transmitter and repeat step 1 to 5 for the other radiator outputs of the transmitter.
6. Divide the impulse response times for each radiator by two. These are the cable signal delays for each radiator.
7. Determine the maximum signal delay.
8. Calculate for each radiator the signal delay difference with the maximum signal delay.
9. Divide the signal delay difference by 33. The rounded off figure is the delay switch position for that radiator.
10. Add delay switch positions to radiators under a balcony, if applicable (see section 1.5.3)
11. Set the delay switches to the calculated delay switch positions.



**Caution:** Turn the delay switches carefully to a new position until you feel that it clicks into position, to prevent that a switch is positioned between two numbers, which would result in a wrong delay setting.

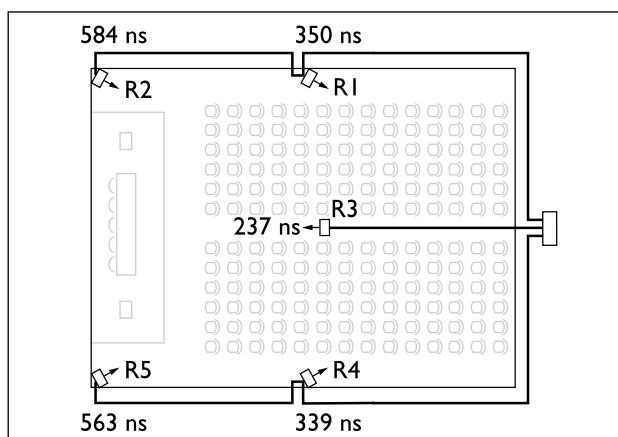


Figure 1.27 System with five radiators and measured impulse response times

Figure 1.27 and table 1.2 illustrate the calculation of the signal delays and the delay switch positions.

## 1.5.2 System with two or more transmitters in one room

When radiators in one multi purpose room are connected to two transmitters, an extra signal delay is added by:

- Transmission from master transmitter to slave transmitter (cable signal delay).
- Transmission through the slave transmitter.

Use the following procedure to determine the delay switch positions in a master-slave configuration:

1. Calculate the cable signal delay for each radiator, using the procedures for a system with one transmitter.
2. Calculate the signal delay of the cable between the master and the slave transmitter in the same way as for cables between a transmitter and a radiator.

Table 1.2 Calculation of the delay switch positions of a system with one transmitter

| Radiator number | Impulse response time [ns] | Cable signal delay [ns] | Signal delay difference [ns] | Delay switch position |
|-----------------|----------------------------|-------------------------|------------------------------|-----------------------|
| 1               | 350                        | $350/2 = 175$           | $292-175 = 117$              | $117/33 = 3.54 = 4$   |
| 2               | 584                        | $584/2 = 292$           | $292-292 = 0$                | $0/33 = 0$            |
| 3               | 237                        | $237/2 = 118$           | $292-118 = 174$              | $174/33 = 5.27 = 5$   |
| 4               | 339                        | $339/2 = 169$           | $292-169 = 123$              | $123/33 = 3.73 = 4$   |
| 5               | 563                        | $573/2 = 281$           | $292-281 = 11$               | $11/33 = 0.33 = 0$    |



**Note:** The calculated delay switch positions based on impulse response time can differ from the calculated delay switch positions based on cable lengths. This is caused by the accuracy of the measurements and the accuracy of the cable signal delay factor per meter as specified by the manufacturer of the cable. If the impulse response time is measured correctly, the calculated delay switch positions will be the most accurate.

3. Add to the cable signal delay of the cable between the master and the slave, the delay of the slave transmitter itself: 33 ns. This gives the master-to-slave signal delay.
4. Add the master-to-slave signal delay to each radiator connected to the slave transmitter.
5. Determine the maximum signal delay.
6. Calculate for each radiator the signal delay difference with the maximum signal delay.
7. Divide the signal delay difference by 33. The rounded off figure is the signal delay switch position for that radiator.
8. Add delay switch positions to radiators under a balcony, if applicable (see section 1.5.3)
9. Set the delay switches to the calculated delay switch positions.



**Caution:** Turn the delay switches carefully to a new position until you feel that it clicks into position, to prevent that a switch is positioned between two numbers, which would result in a wrong delay setting.



**Note:** When a master-slave configuration is used for rooms which are always separated, the delay switch positions can be determined per system and the delay caused by transmission from master to slave transmitter can be ignored.

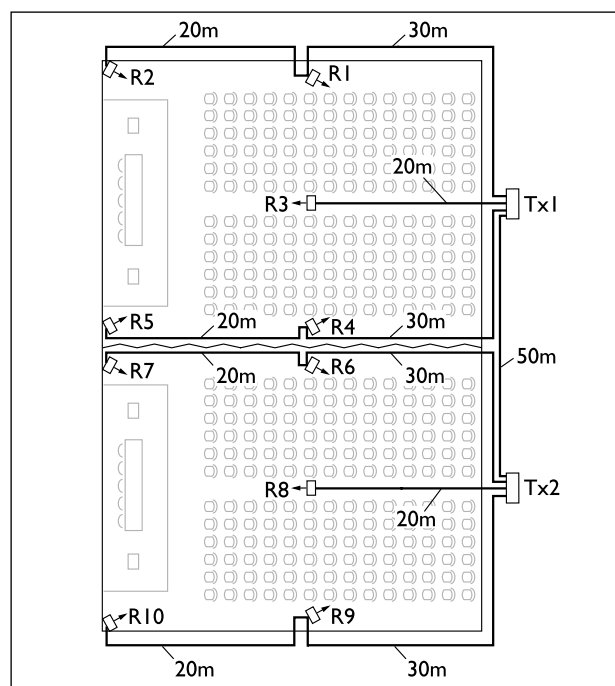


Figure 1.28, table 1.1, table 1.3 and table 1.4 illustrate the calculation of the extra master-slave signal delay.

Figure 1.28 System with master and slave transmitter in multi purpose room

Table 1.3 Calculation of the master-to-slave signal delays

| Cable length master-slave transmitter [m] | Cable signal delay per meter [ns/m] | Cable signal delay [ns] | Signal delay slave transmitter [ns] | Master-to-slave signal delay [na] |
|-------------------------------------------|-------------------------------------|-------------------------|-------------------------------------|-----------------------------------|
| 50                                        | 5.6                                 | $50 \times 5.6 = 280$   | 33                                  | $280 + 33 = 313$                  |

Table 1.4 Calculation of the delay switch positions of a system with two transmitters

| Radiator number | Transmitter | Master-to-slave signal | Cable signal delay [ns] | Total signal delay [ns] | Signal delay difference | Delay switch position   |
|-----------------|-------------|------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 1               | Master      | 0                      | 168                     | $0 + 168 = 168$         | $593 - 168 = 425$       | $425 / 33 = 12.88 = 13$ |
| 2               | Master      | 0                      | 280                     | $0 + 280 = 280$         | $593 - 280 = 313$       | $313 / 33 = 9.48 = 9$   |
| 3               | Master      | 0                      | 112                     | $0 + 112 = 112$         | $593 - 112 = 481$       | $481 / 33 = 14.58 = 15$ |
| 4               | Master      | 0                      | 168                     | $0 + 168 = 168$         | $593 - 168 = 425$       | $425 / 33 = 12.88 = 13$ |
| 5               | Master      | 0                      | 280                     | $0 + 280 = 280$         | $593 - 280 = 313$       | $313 / 33 = 9.48 = 9$   |
| 6               | Slave       | 313                    | 168                     | $313 + 168 = 481$       | $593 - 481 = 112$       | $112 / 33 = 3.39 = 3$   |
| 7               | Slave       | 313                    | 280                     | $313 + 280 = 593$       | $593 - 593 = 0$         | $0 / 33 = 0$            |
| 8               | Slave       | 313                    | 112                     | $313 + 112 = 425$       | $593 - 425 = 168$       | $168 / 33 = 5.09 = 5$   |
| 9               | Slave       | 313                    | 168                     | $313 + 168 = 481$       | $593 - 481 = 112$       | $112 / 33 = 3.39 = 3$   |
| 10              | Slave       | 313                    | 280                     | $313 + 280 = 593$       | $593 - 593 = 0$         | $0 / 33 = 0$            |

### 1.5.3 System with more than 4 carriers and a radiator under a balcony

figure 1.29 illustrates a situation in which a radiation signal delay occurs and which can be compensated for. For systems with more than four carriers, add one delay switch position per 10 meter (33 feet) difference in signal path length to the radiators which are closest to the overlapping coverage area. In figure 1.29 the signal path length difference is 12 meter. Add one delay switch position to the calculated switch position(s) for the radiator(s) under the balcony.

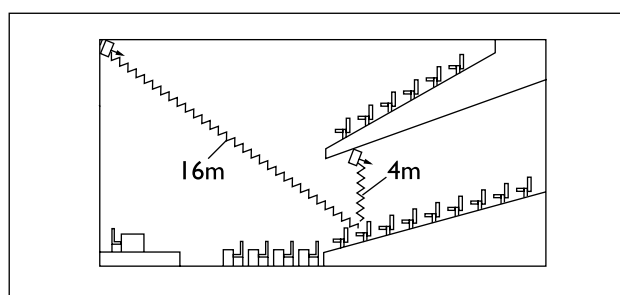


Figure 1.29 Radiation path length difference for two radiators

## 1.6 Testing the coverage area

An extensive reception quality test must be done to make sure that the whole area is covered with IR radiation of adequate strength and that there are no black spots. Such a test can be done in two ways:

### Testing during installation

1. Check that all radiators are connected and powered up and that no loose cables are connected to a radiator. Switch the transmitter off and on to re-initialise the auto equalisation of the radiators.
2. Set the transmitter in the Test-mode (see section 2.5.7). For each channel, a different test tone frequency will be transmitted.
3. Set a receiver on the highest available channel and listen via the headphones to the transmitted test tone.
4. Test all positions and directions (see next paragraph).

### Testing during a meeting

1. Set a receiver in the Test-mode and select the highest available carrier. The quality of the received carrier signal is indicated on the display of the receiver (see section 4.3).
2. Test all positions and directions (see next paragraph). The quality indication should be between 00 and 39 (good reception).

### Testing all positions and directions

With the transmitter and receiver in one of the two test modes, go around the conference hall and test the reception quality at every position where the infra-red signals must be received. When an area is detected where there is bad reception or even no reception at all, two main causes must be considered:

#### Bad coverage

The receiver can not pick-up infra-red radiation of adequate strength. This can be because the tested position is outside the footprint of the installed radiators or the radiation is blocked by obstacles such as a column, an overhanging balcony or other large objects.

Check that you used the correct footprints for the system design, that radiators with enough output power are installed and that a radiator is not accidentally switched to half power operation. When the bad reception is caused by a blocked radiation path, try to remove the blocking obstacle or add an extra radiator to cover the shaded area.

#### Black spots

The receiver picks-up IR signals from two radiators which cancel out each other. The multipath effect can be identified by the observation that the bad reception only occurs along a specific line and/or when good reception returns when the receiver is rotated to another direction. This can be confirmed by keeping the receiver in the position and direction with the bad reception and then either shading-off the radiation from one radiator with your hand or switching off one radiator. If this improves the reception quality, then the multipath effect is causing the problem. Note that IR radiation that is reflected from a surface with a high reflectability can also cause multipath problems.

Check that the signal delay compensation switches on the radiators are set to the correct value and that a switch is not accidentally positioned between two numbers. Re-check your system design. When necessary, reduce the distance between the two radiators that cause the problem and/or add an extra radiator.

Note that due to the physical characteristics of the signal distribution, it is not always possible to completely avoid multi path effects.

## 2 Infra-Red Transmitters (LBB 4502/xx)

### 2.1 Description

The transmitter is the central element of the Integrus system. It accepts asymmetrical audio sources from a maximum of 32 external channels (dependent on the transmitter type) and can be used with the Digital Congress Network (DCN) conference system or analogue discussion and interpretation systems such as the CCS 800 (with up to 12 interpreters desks), or as a stand-alone system distributing external audio sources. The transmitter is suitable for either table-top or 19-inch rack-mounted use. Four feet (for table top use) and two mounting brackets (for rack mounting) are supplied. The mounting brackets can also be used to mount the transmitter to a flat surface.

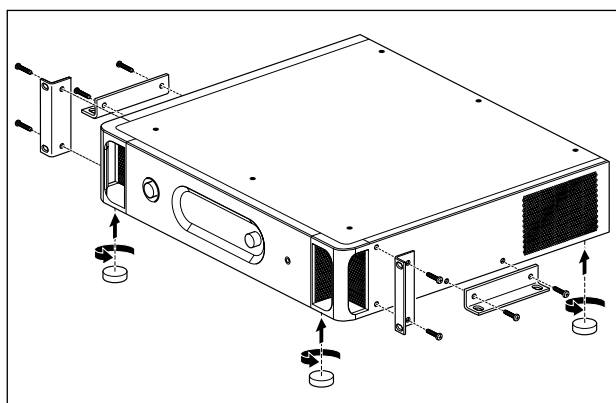


Figure 2.1 Transmitter with optional mounting brackets and table-top feet

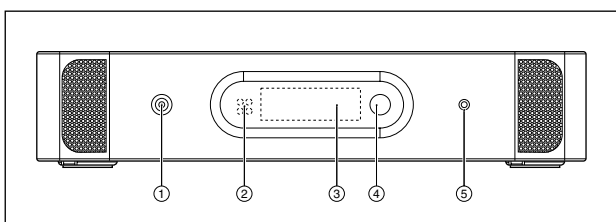


Figure 2.2 Transmitter, front view

#### Figure 2.2:

1. **Mains on/off switch** – After switching the mains on, the transmitter starts up and the display (3) will light-up.

2. **Mini IR-radiator** – Four IREDs, transmitting the same infra-red signal as the radiator output. This can be used for monitoring purposes. They can be disabled via the configuration menu.
3. **Menu display** – A 2x16 character LCD-display gives information about the transmitter status. It is also used as a an interactive display for configuring the system.
4. **Menu button** – A turn-and-push button to operate the configuration software in combination with the display (3).
5. **Monitoring headphone output** – A 3.5 mm (0.14 inch) jack socket to connect a headphone for monitoring purposes. It can be disabled via the configuration menu.



**Note:** The mini IR-radiator and the headphone output can also be permanently disabled by removing two resistors. Consult your regular service contact for more information.

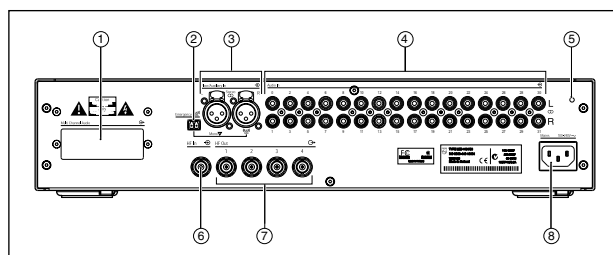


Figure 2.3 Transmitter, rear view

#### Figure 2.3:

1. **Interface module slot** – An optional audio interface module can be mounted in the transmitter housing. Its connectors are accessible via an opening at the back of the transmitter.
2. **Emergency switch connector** – A terminal block socket for a single, 'normally open' switch. When the switch is closed, the audio signal on the Aux-right input is distributed on all output channels, overriding all other audio inputs. A matching cable connector is provided.
3. **Auxiliary audio inputs** – Two female XLR connectors for extra audio inputs. They can be used to connect auxiliary symmetrical audio signals such as a music installation, the floor language or emergency messages.

4. **Audio signal inputs** – 4, 8, 16 or 32 cinch plugs to connect external asymmetrical audio input signals. The number of connectors depends on the transmitter type.
5. **Earth connection point** - Only used for factory testing purposes.
6. **Radiator signal loop-through input** – A HF BNC connector to loop-through the radiator output of another transmitter.
7. **Radiator signal outputs** – Four HF BNC connectors, used to connect the radiators. Up to 30 radiators can be loop-through connected to each output.
8. **Mains input** – Euro mains socket. The transmitter has automatic mains voltage selection. A mains cable is provided.



**Note:** When the DCN interface is used in combination with audio signals connected to the cinch inputs, the DCN and audio signals on corresponding inputs are mixed.

## 2.2.2 Mounting an interface module in the transmitter housing



**Warning:** Before opening the transmitter housing, make sure that the mains power and all other connections are disconnected!

## 2.2 Audio interface modules

### 2.2.1 DCN Interface Module (LBB 3423/00)

A DCN Interface Module is required if the transmitter is to be used with the DCN Conference System. The module must be mounted in the transmitter housing (see section 2.2.2).

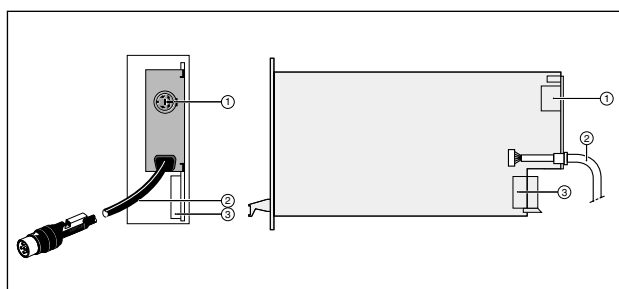


Figure 2.4 DCN Interface Module

#### Figure 2.4:

1. **DCN output connector** – A 6-pole trunk output female DIN connector for loop-through interconnection with DCN units.
2. **DCN input cable** – A 2 m (6 ft 6 in) trunk input cable with 6-pole male DIN connector for loop-through interconnection with DCN units.
3. **PCB connector**

When the DCN system supply voltage on the trunk input switches off, the DCN Interface Module automatically switches the transmitter to standby. When the DCN system supply voltage switches on, the transmitter is switched to operating mode.



**Warning:** ICs and many other electronic components are susceptible to electrostatic discharge (ESD). Take preventive measures when handling the interface modules. Keep the PCBs as long as possible in their protective packing. Wear an anti-ESD bracelet.

Follow the instructions below to mount an interface module in the transmitter housing. The numbers refer to figure 2.5, figure 2.6 and figure 2.7.

1. Remove the top cover of the transmitter housing.
2. Remove the interface module slot cover (4) at the back of the transmitter. Keep the screws (7).
3. Remove the front plate (2) of the interface module (1). Keep the screws (5). The front plate is not used.
4. Remove the screws (6) that connect the back plate (3) of the module to the PCB. Keep the screws.
5. Mount the slot cover (4) and the module's back plate (3) to the module's PCB. Use the screws from step 4.
6. Insert the module (1) (with the components faced down) into the transmitter housing and push it firmly into the PCB connector (9).
7. Fasten the slot cover (4) to the back of the transmitter housing. Use the screws (7) from step 2.
8. Fasten the module's PCB to the distance studs (8). Use the screws (5) from step 3.
9. Close the transmitter housing.



**Warning:** To prevent damage to the PCB connectors (9), be sure that the connectors are aligned properly before pushing the module in.

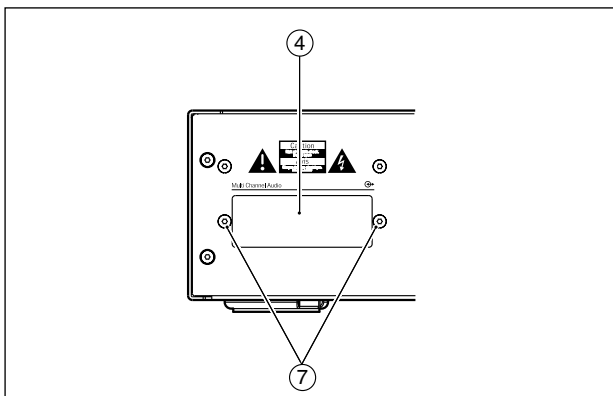


Figure 2.5 Interface module slot cover

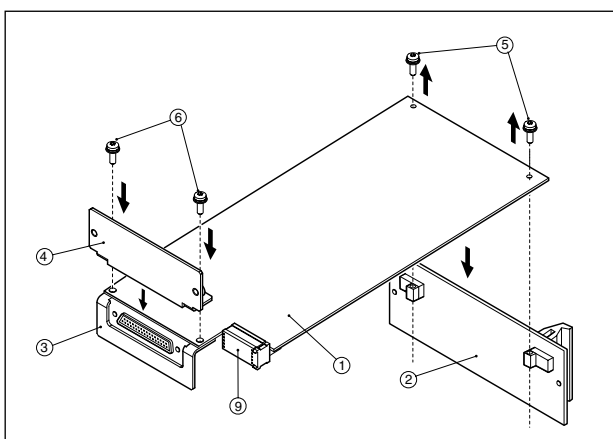


Figure 2.6 Preparing an interface module for mounting

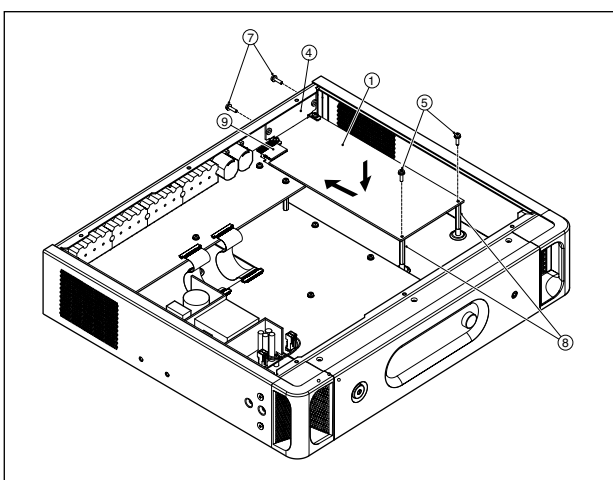


Figure 2.7 Mounting an interface module in the transmitter housing

## 2.3 Connections

This chapter gives an overview of typical system connections using the LBB 4502 transmitter:

- Connecting the DCN system
- Connecting other external audio sources
- Connecting an emergency signal switch
- Connecting to another transmitter

### 2.3.1 Connecting the DCN system

The transmitter requires the DCN Interface Module (LBB 3423) to interface with the Digital Congress Network (DCN). This module must be mounted in the transmitter housing (see section 2.2.2).

The connections between DCN units and the transmitter are made in a loop-through configuration via the DCN 6-pole circular connectors on the module's rear panel. See the DCN Installation and Operating Manual for more information.

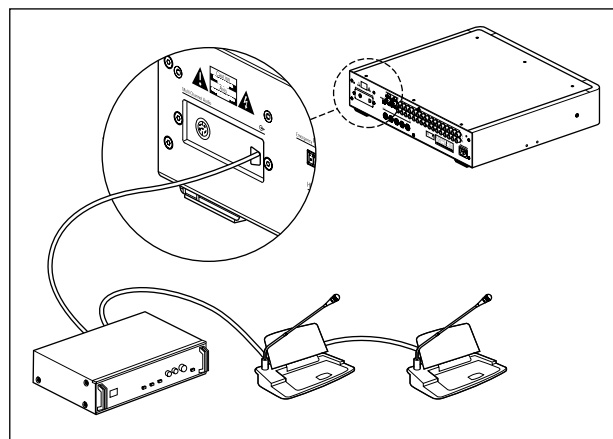


Figure 2.8 Connecting the DCN systems to the Modular IR transmitter

### 2.3.2 Connecting other external audio sources

The transmitter has up to 32 audio inputs (depending on the transmitter type) to interface with external asymmetrical audio sources, such as congress systems from other manufacturers or for music distribution. The audio signals (stereo or mono) are connected to the audio input cinch connectors.



**Note:** When the cinch audio inputs are used in combination with inputs via one of the interface modules, the signals on corresponding channels are mixed. This situation should normally be avoided by using higher-numbered cinch audio inputs.

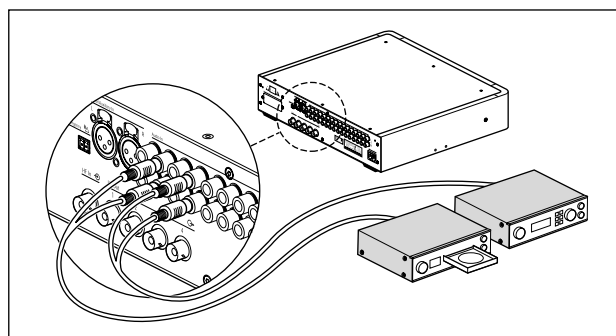


Figure 2.9 Connecting external audio sources to the Modular IR transmitter

### 2.3.3 Connecting an emergency signal

To use the emergency signal function, a switch (normally-open) must be connected to the emergency switch connector. When the switch is closed, the audio signal on the Aux-Right input is distributed to all output channels, overriding all other audio inputs.

The Aux. Input mode of the transmitter must be set to 'Mono + Emergency' (see section 2.5.13).

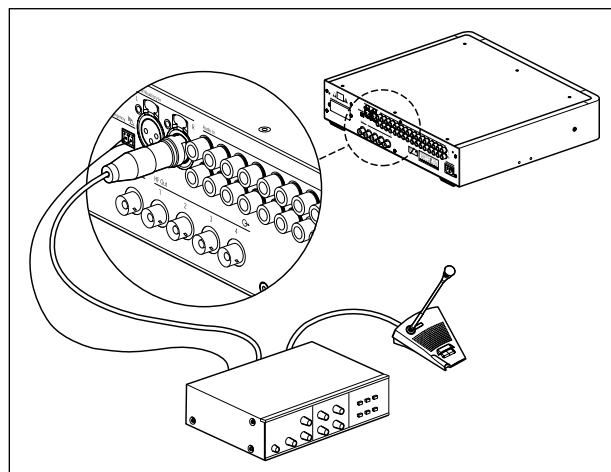


Figure 2.10 Connecting an emergency signal

### 2.3.4 Connecting to another transmitter

The transmitter can be operated in slave mode to loop-through the IR radiator signals from a master transmitter. One of the four radiator outputs of the master transmitter is connected with an RG59 cable to the radiator signal loop-through input of the slave transmitter.

The Transmission mode of the slave transmitter must be set to 'Slave' (see section 2.5.7).

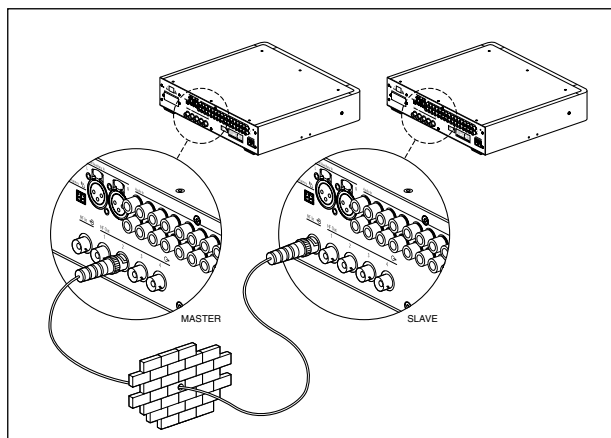


Figure 2.11 Connecting to another transmitter

## 2.4 Using the configuration menu

### 2.4.1 Overview

All configuration and operation options of the transmitter are set via an interactive menu, using a 2x16 character LCD display and a 'turn-and-push' menu button. Figure 2.12 gives an overview of the menu structure. A general description of how to use the menu is given in section 2.4.2. Some examples are given in section 2.4.3. The detailed descriptions of all menu items can be found in section 2.5.

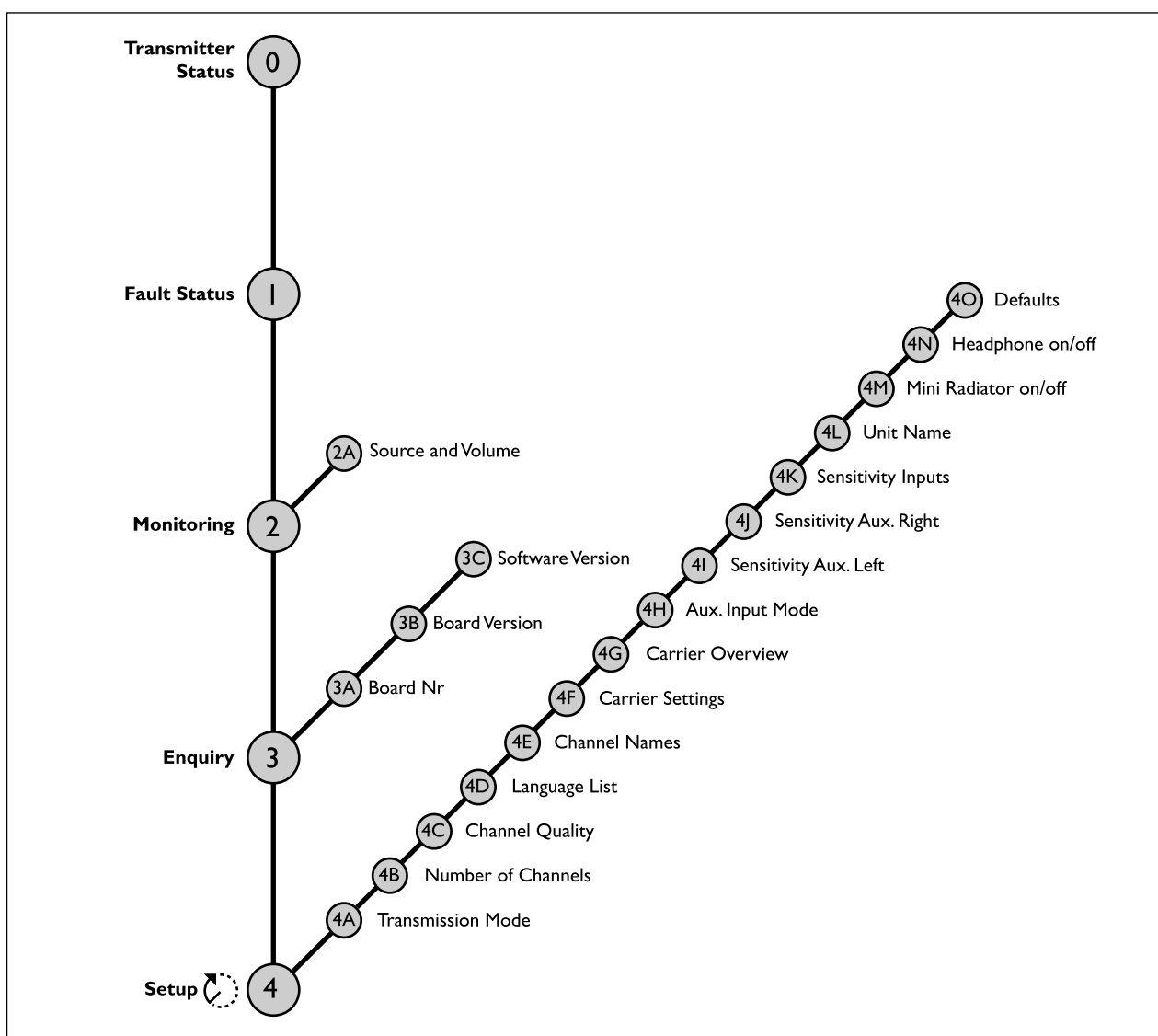


Figure 2.12 Menu overview

## 2.4.2 Navigate through the menu

Operating the menu is always a sequence of alternating turns and pushes:

**Turn** the button to:

- Cycle through the menu items within a menu (the menu item number and title on the first line is blinking).
- Go to a settable option within a menu item (a blinking cursor moves through the menu screen).
- Cycle through the available values for a settable option (the value is blinking).

**Push** the button to:

- Confirm a chosen menu item (the menu item number and title stops blinking, a blinking cursor appears).
- Go to a sub-menu (the sub-menu item character starts blinking).
- Confirm the selection of a settable option (the cursor disappears, the option value starts blinking).
- Confirm a selected value for a settable option (the value stops blinking, the cursor appears again).

After 5 minutes of inactivity, the display automatically switches back to the first item of the Main menu (Transmitter Status).

Each menu item is identified by a number (for the Main menu) or by a number plus a character (for the sub-menus). The item identification can be found at the start of the first line and is used to navigate to and from sub-menus.

Most menu items have one or more settable configuration options. The value of an option can be changed by selecting a value from a list of available values.

### To navigate through the Main menu:

1. Turn the button to move through the Main menu items. The item number and title starts blinking. (The first item, Transmitter Status, doesn't blink.)

### To jump to a sub-menu:

1. Navigate in the Main menu to an item with three dots (e.g. 'Setup ...').
2. Push the button to go to the sub menu. The sub-menu item character and title starts blinking.



**Note:** To enter the Setup sub-menu, push and hold the button for at least **3 seconds**.

### To navigate through a sub-menu:

1. Turn the button to move the cursor to the sub-menu item character.
2. Push the button. The item character and title starts blinking.
3. Turn to select another sub-menu item character.
4. Push to confirm the selection.

### To change option values

1. Navigate to the applicable menu item.
2. Turn the button to move the cursor to the option value you want to change.
3. Push the button to activate the option. The option value starts to blink.
4. Turn the button to select a new option value.
5. Push the button to confirm the new value. The option value stops blinking.
6. Turn the button to move the cursor to another settable option (when available) and repeat steps 3 to 5.

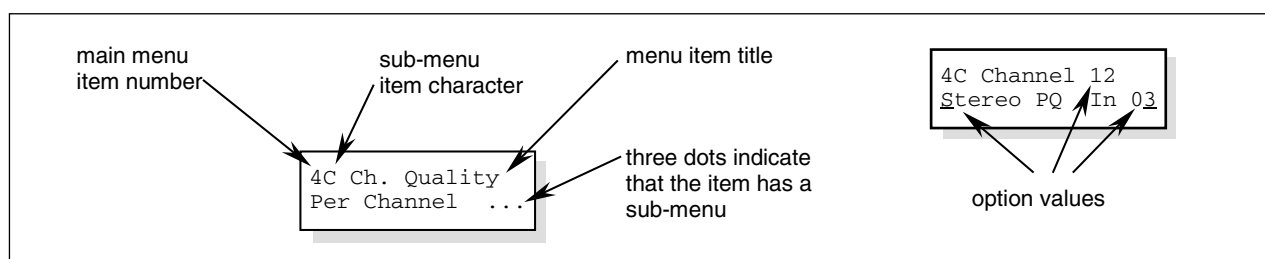
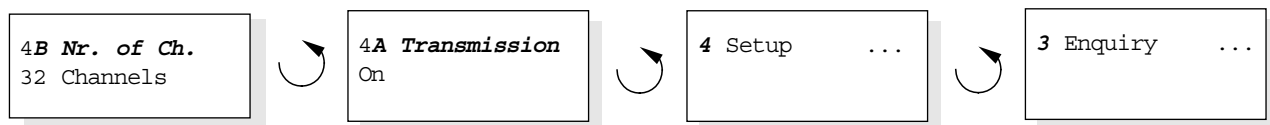


Figure 2.13 Menu item screen elements

### To jump back from a sub-menu to an item of the Main menu:

1. Turn the button to move the cursor to the Main menu item number.
2. Push the button. The item number and title starts blinking.
3. Turn to select another item number.
4. Push to confirm the selection.

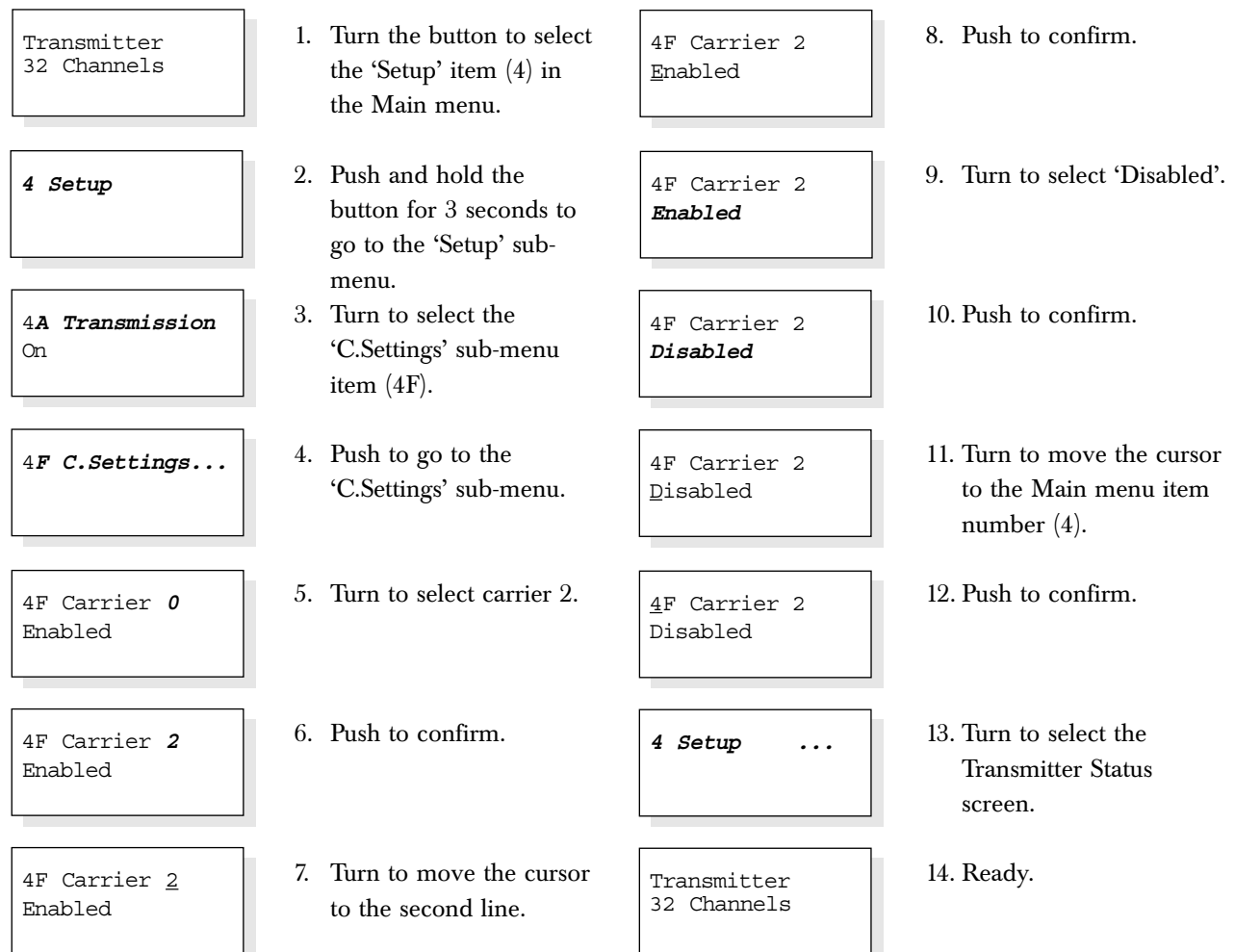
When you are turning counter-clockwise through sub-menu items, the display jumps automatically to the Main menu after you have reached the first item (A) of the sub-menu. Example:



### 2.4.3 Examples

Each step in the examples below shows the text on the display and the action to go to the next step. Bold text in italics (*text*) indicates that the text is blinking. An underscore (   ) indicates the position of the cursor. Each example starts at the Transmitter Status screen.

#### Example 1: Disable carrier 2. (See also section 2.5.10).



**Example 2:** Assign a new user defined name to channel 12. (See also section 2.5.10.)

|                            |                                                                          |                             |                                                               |
|----------------------------|--------------------------------------------------------------------------|-----------------------------|---------------------------------------------------------------|
| Transmitter<br>32 Channels | 1. Turn the button to select the 'Setup' item (4) in the Main menu.      | 4E Channel 12<br>• - - -    | 11. Turn to move the cursor to the first dash.                |
| 4 Setup ...                | 2. Push and hold the button for 3 seconds to go to the 'Setup' sub-menu. | 4E Channel 12<br>• - - -    | 12. Push to confirm.                                          |
| 4A Transmission<br>On      | 3. Turn to select the 'Ch. Names' sub-menu item (4E).                    | 4E Channel 12<br>• - - -    | 13. Turn to select the first character (C).                   |
| 4E Ch.Names ...<br>Floor   | 4. Push to go to the 'Ch. Names' sub-menu.                               | 4E Channel 12<br>• C--      | 14. Push to confirm this character.                           |
| 4E Channel 00<br>Spanish   | 5. Turn to select the required channel number (12).                      | 4E Channel 12<br>• C--      | 15. Repeat steps 11 to 14 for the other characters.           |
| 4E Channel 12<br>Spanish   | 6. Push to confirm.                                                      | 4E Channel 12<br>• CD Music | 16. Turn to move the cursor to the Main menu item number (4). |
| 4E Channel 12<br>Spanish   | 7. Turn to move the cursor to the start of the second line.              | 4E Channel 12<br>• CD Music | 17. Push to confirm.                                          |
| 4F Carrier 12<br>Spanisch  | 8. Push to confirm.                                                      | 4 Setup ...                 | 18. Turn to select the Transmitter Status screen.             |
| 4E Channel 12<br>Spanish   | 9. Turn clockwise until the channel name changes to: • - - -             | Transmitter<br>32 Channels  | 19 Ready.                                                     |
| 4E Channel 12<br>• - - -   | 10. Push to confirm.                                                     |                             |                                                               |

**Example 3:** Set channel 11 to transmit a Stereo signal in Premium Quality, using audio inputs 14 (L) and 15 (R) as source.  
(See also section 2.5.9.)

|                                          |                                                                          |                                          |                                                            |
|------------------------------------------|--------------------------------------------------------------------------|------------------------------------------|------------------------------------------------------------|
| Transmitter<br>32 Channels               | 1. Turn the button to select the 'Setup' item (4) in the Main menu.      | 4C Channel <b>00</b><br>Mono SQ In 00    | 9. Turn to select the required channel number (11).        |
| 4 Setup ...                              | 2. Push and hold the button for 3 seconds to go to the 'Setup' sub-menu. | 4C Channel <b>11</b><br>Mono SQ In 00    | 10. Push to confirm.                                       |
| 4A Transmission<br>On                    | 3. Turn to select the 'Channel Quality' sub-menu item (4C).              | 4C Channel 1 <u>1</u><br>Mono SQ In 11   | 11. Turn to move the cursor to the quality option.         |
| 4C Ch. Quality<br>All Mono SQ            | 4. Push to confirm.                                                      | 4C Channel 11<br><u>Mono SQ</u> In 11    | 12. Push to confirm.                                       |
| 4C Ch. Quality<br>All Mono SQ            | 5. Turn to move the cursor to the option on the second line.             | 4C Channel 11<br><b>Mono SQ</b> In 11    | 13. Turn to select the required quality value (Stereo PQ). |
| 4C Ch. Quality<br><u>A</u> ll Mono SQ    | 6. Push to confirm.                                                      | 4C Channel 11<br><b>Stereo PQ</b> In 11  | 14. Push to confirm. *                                     |
| 4C Ch. Quality<br><b>All Mono SQ</b>     | 7. Turn to select the option value 'Per Channel ...'.                    | 4C Channel 11<br><u>S</u> tereo PQ In 12 | 15. Turn to move the cursor to the input number.           |
| 4C Ch. Quality<br><b>Per Channel ...</b> | 8. Push to go to the 'Channel' sub-menu (4C).                            | 4C Channel 11<br>Stereo PQ In <u>12</u>  | 16. Push to confirm.                                       |

\* Note that after selecting 'Stereo' as input mode (step 14) the input number changes automatically to the next even number (12), which is the input number of the **left** signal.

4C Channel 11  
Stereo PQ In **12**

17. Turn to select the required input number (14).

4C Channel 11  
Stereo PQ In **14**

18. Push to confirm.

4C Channel 11  
Stereo PQ In 14

19. Turn to move the cursor to the Main menu item number (4).

4C Channel 11  
Stereo PQ In 14

20. Push to confirm.

**4 Setup** ...

21. Turn to select the Transmitter Status screen.

Transmitter  
32 Channels

22. Ready.

## 2.5 Configuration and operation

The next sections give descriptions of the possible configuration options. Each description is followed by the relevant menu items with detailed information per menu option. The default values (see section 'Reset all options to factory defaults') are indicated by an asterix (\*) when applicable.

### 2.5.1 Start-up

When the transmitter is switched on, the display shows the Transmitter Status screen, which is the first item of the Main menu. The display also goes to this screen after 5 minutes of inactivity.

In case the system detects a fault, the display shows a flashing fault message (see section 2.5.4).

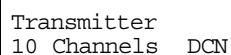
### 2.5.2 Main menu

The main menu contains the screens to view the transmitter status and the radiator fault status. It also contains the entry points to the Monitoring, Enquiry and Setup sub-menus.

| Menu Item                 | Description                                                |
|---------------------------|------------------------------------------------------------|
| <b>Transmitter Status</b> | Shows the transmitter status (see section 2.5.3)           |
| <b>1 Fault Status</b>     | Shows the radiator fault status (see section 2.5.4)        |
| <b>2 Monitoring . . .</b> | Go to the 'Monitoring' sub-menu (see section 2.5.5)        |
| <b>3 Enquiry . . .</b>    | Go to the 'Enquiry' sub-menu (see section 2.5.6)           |
| <b>4 Setup . . .</b>      | Go to the 'Setup' sub-menu (see sections 2.5.7 and higher) |

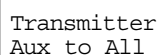
### 2.5.3 View transmitter status

The first screen of the Main menu gives information about the present status of the transmitter. The screens shows the name of the transmitter (1st line) and the present transmission mode (2nd line). See examples below. See section 2.5.7 to change the transmission mode.



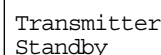
Transmitter  
10 Channels DCN

Transmitter is transmitting  
10 channels from DCN.



Transmitter  
Aux to All

Transmitter is transmitting the  
Aux inputs on all channels.



Transmitter  
Standby

Transmitter is in Standby mode  
(not transmitting).

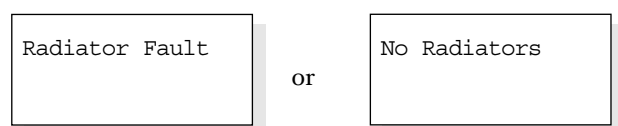
| Menu Items                | Options (read only)                                                                                                                 | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Transmitter Status</b> | <b><u>Name</u></b>                                                                                                                  | The first line shows the user defined name of the transmitter (see section 2.5.15).                                                                                                                                                                                                                                                                                                                                                                                                      |
|                           | <b><u>Mode:</u></b><br>- <u>nn</u> Channels<br>- Aux to All<br>- <u>nn</u> Ch. Test<br>- Slave<br><br>- Standby<br>- Emergency Call | The second line shows the actual transmission mode:<br>Audio signals are distributed on <u>nn</u> channels.<br>The signal on the Aux. inputs is distributed on all channels.<br>The test signals are distributed on <u>nn</u> channels.<br>The transmitter operates in slave-mode: the radiator signal on the slave input is looped-through to all radiator outputs.<br>The transmitter is in stand by mode.<br>An emergency signal from the Aux. inputs is distributed to all channels. |
|                           | <b><u>DCN</u></b>                                                                                                                   | The text 'DCN' is shown at the right side of the second line when a DCN system is connected to the transmitter.                                                                                                                                                                                                                                                                                                                                                                          |

## 2.5.4 View fault status

The fault status of the radiators can be seen in the second screen of the Main menu:

| Menu Items            | Value (read only)                                                         | Description                                                                                                                                                         |
|-----------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1 Fault Status</b> | <b><u>Fault:</u></b><br>- No Faults<br>- Radiator Fault<br>- No Radiators | The connected radiators function without problems.<br>One of the connected radiators is not functioning properly.<br>No radiators are connected to the transmitter. |

When the system detects a failure for the first time, a flashing fault message pops-up on any menu screen:



Push the menu button to remove the fault message from the screen and to go back to the menu screen that was visible before the fault message popped-up. The flashing message will also disappear when the fault has been resolved.

## 2.5.5 Set monitoring options

The Monitoring sub-menu (2) is used to set which signal is sent to the monitoring headphone output. It can be one of the inputs, one of the channels or no signal. When the sensitivity of one of the inputs is being changed in the Setup menu (4I, 4J or 4K), or when assigning inputs to channels (menu 4C, Per Channel), the monitoring output automatically switches temporarily to that source, even when the option 'None' has been chosen.

When the headphone output is disabled (see section 2.5.17), the output level can not be changed and the level indicator is not visible.

| Menu Item        | Option          | Value 1                        | Value 2                        | Description                                                                                                                                        |
|------------------|-----------------|--------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 2A Source/Volume | <b>Source:</b>  |                                |                                |                                                                                                                                                    |
|                  | - In. <u>nn</u> | <b>Input nr:</b><br>00 ... 31  | <b>Volume:</b><br>-31 ... 0 dB | The signal from audio input <u>nn</u> is available on the monitoring headphone output.                                                             |
|                  | - Ch. <u>nn</u> | <b>Channel nr:</b><br>00 ...31 | <b>Volume:</b><br>-31 ... 0 dB | The signal on channel <u>nn</u> is available on the monitoring headphone output.                                                                   |
|                  | - Aux.L         |                                | <b>Volume:</b><br>-31 ... 0 dB | The signal on the Aux. Left input is available on the monitoring headphone output.                                                                 |
|                  | - Aux.R         |                                | <b>Volume:</b><br>-31 ... 0 dB | The signal on the Aux. Right input is available on the monitoring headphone output.                                                                |
|                  | - None          |                                | <b>Volume:</b><br>-31 ... 0 dB | The monitoring headphone output is switched off during normal operation, but is active when the sensitivity of one of the inputs is being changed. |

The 'Source/volume' screen also displays level meters (two for a stereo source, one for a mono source) for a visual indication of the actual signal strength: ■ = low level, ■ = high level, ▲ = overflow.

## 2.5.6 View version information

In the Enquiry sub-menu (3), version information of the transmitter can be found. This information should be mentioned in service requests or failure reports.

| Menu Item           | Value (read only) | Description                                             |
|---------------------|-------------------|---------------------------------------------------------|
| 3A Board Nr         | e.g. 19.1.000001  | Shows the serial number of the transmitter board.       |
| 3B Board Version    | e.g. 01.00        | Shows the version number of the transmitter board.      |
| 3C Software Version | e.g. 1.00.0001    | Shows the version number of the configuration software. |

### 2.5.7 Set transmission mode

The Transmission Mode menu item (4A) is used to select which signals will be distributed over the channels. It is also possible to switch all channels off (Standby).

When using a DCN interface module of version 01.05 or higher, the transmitter is automatically switched to 'Standby' when the connected DCN system is switched off. When the DCN system is switched on, the transmitter is automatically switched to 'On'.

| Menu Item       | Option       | Description                                                                                                                                                                           |
|-----------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4A Transmission | <b>Mode:</b> |                                                                                                                                                                                       |
|                 | - Standby    | All channels are switched off, no signals are distributed.                                                                                                                            |
|                 | * - On       | Normal transmission. Input signals are distributed on the channels as set in the Channel Quality sub-menu (4C).                                                                       |
|                 | - Aux to All | The signals on the Auxiliary inputs are distributed on <b>all</b> channels.                                                                                                           |
|                 | - Test       | A different test tone is distributed on each channel. The frequency increases with increasing channel number. For stereo channels the tone for left and right will also be different. |
|                 | - Slave      | The radiator signal on the slave input is looped-through to all radiators.                                                                                                            |

### 2.5.8 Set number of channels

Via sub-menu item 4B the number of channels that will be used can be set. Note that the maximum number of channels depends on the transmitter type (4, 8, 16 or 32 channels) and the chosen quality modes.

When a DCN system is connected to the transmitter, (using a DCN interface module of version 01.05 or higher), the number of channels can be automatically set by the DCN system.

| Menu Items    | Option                   | Description                                                                                                                                                                                                                                                         |
|---------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4B Nr. of Ch. | <b>Nr. of channels</b>   |                                                                                                                                                                                                                                                                     |
|               | * - Automatic: <u>nn</u> | The number of used channels is set automatically to the maximum possible number of channels (depending on transmitter type and the selected quality modes). When a DCN system is connected, the number of channels is determined by the settings of the DCN-system. |
|               | - Manual: <u>nn</u>      | Set the number of used channels (the maximum number depends on the transmitter type and the selected quality modes).<br>An asterix (*) is shown when the selected number is not possible because it is higher than the maximum number of channels.                  |

### 2.5.9 Set channel quality and assign inputs to channels

The audio quality of the channels (mono/stereo, standard/premium) can be set in sub-menu 4C. The quality can be set the same for all channels or for each channel separately. Note that choosing stereo and/or premium quality uses more bandwidth and decreases the number of available channels (see section 1.2.4).

In stereo mode, the left signal is always an even numbered input. The next higher input number is used for the right signal.

When the quality is set the same for all channels with the 'All Mono' or 'All Stereo' options, the inputs are assigned automatically to the channels as indicated in the table below:

| All Mono |       | All Stereo |         |         |
|----------|-------|------------|---------|---------|
| Channel  | Input | Channel    | Input L | Input R |
| 00       | 00    | 00         | 00      | 01      |
| 01       | 01    | 01         | 02      | 03      |
| ...      | ...   | ...        | ...     | ...     |
| 31       | 31    | 15         | 30      | 31      |

With menu option 4C (Per Channel Settings), the assignment can also be done for each channel separately.

| Menu Items     | Option            | Description                                                  |
|----------------|-------------------|--------------------------------------------------------------|
| 4C Ch. Quality | <u>Quality:</u>   |                                                              |
|                | * All Mono SQ     | Set all channels to mono, standard quality.                  |
|                | All Mono PQ       | Set all channels to mono, premium quality.                   |
|                | All Stereo SQ     | Set all channels to stereo, standard quality.                |
|                | All Stereo PQ     | Set all channels to stereo, premium quality.                 |
|                | Per Channel . . . | Select this option to go to the 'Per Channel Settings' menu. |

## Per Channel Settings:

| Menu Item            | Options                                                                                 | Description                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4C Channel <u>nn</u> | <u>Channel nr.:</u><br>00 ... 31                                                        | Select which channel to configure.                                                                                                                                                                                                                                                                                                                                                                                              |
|                      | <u>Quality:</u><br>- Disabled<br>* - Mono SQ<br>- Mono PQ<br>- Stereo SQ<br>- Stereo PQ | <p>Disable selected channel.</p> <p>Set selected channel to mono, standard quality.</p> <p>Set selected channel to mono, premium quality.</p> <p>Set selected channel to stereo, standard quality.</p> <p>Set selected channel to stereo, premium quality.</p> <p>An asterix (*) is shown when the selected quality mode is not possible, because the total bandwidth of the carrier will be surpassed (see section 1.2.4).</p> |
|                      | <u>Input:</u><br>00 ... 27                                                              | Select the audio input that should be distributed on the selected channel. For stereo signals the input number of the left signal (even number) should be selected. (Not more than 28 inputs can be rerouted.)                                                                                                                                                                                                                  |

### 2.5.10 Set channel names

Each channel can be assigned a name via the Channel Names menu (4E). This can be 'Floor' or one of 30 pre-defined ISO language names. Also up to 32 userdefined names can be added.

See also example 2 in section 0. The language in which the pre-defined names are presented can be chosen via the Language List menu option (4D).

| Menu Item            | Options                                                                              | Description                                                                                                                                                                                                                                                  |
|----------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4E Ch. Names ...     |                                                                                      | Push the button to go to the sub-menu.                                                                                                                                                                                                                       |
| 4E Channel <u>nn</u> | <u>Channel nr.:</u><br>00 ... 31                                                     | Select which channel to name.                                                                                                                                                                                                                                |
|                      | <u>Language name:</u><br>* - 'Floor'<br>- ISO language names<br>- User defined names | <p>Set the name for the selected channel.</p> <p>Use this name for the channel that carries the 'Floor' language.</p> <p>Choose from pre-programmed ISO language names.</p> <p>Up to 32 user defined names (max. 12 characters) can be added and chosen.</p> |

| Menu Items       | Option           | Description                                                                                  |
|------------------|------------------|----------------------------------------------------------------------------------------------|
| 4D Language List | <u>Language:</u> |                                                                                              |
|                  | * English        | Present language list in English.                                                            |
|                  | French           | Present language list in French.                                                             |
|                  | Original         | Present each language name in it's original language (e.g. English, Français, Deutsch, etc.) |

### 2.5.11 Disable or enable carriers

Normally the channels are automatically assigned to the available carriers. However, when the reception quality of a specific carrier is not good, that carrier can be disabled manually. The channels are then automatically re-assigned to the next available carriers. Each of the 8 carriers (0 to 7) can be disabled or enabled in the Carrier Settings menu (4C).

| Menu Items          | Options             | Description                             |
|---------------------|---------------------|-----------------------------------------|
| 4F C.Settings ...   |                     | Push the button to go to the sub-menu.  |
| 4F Carrier <u>n</u> | <u>Carrier nr.:</u> |                                         |
|                     | 0 ... 7             | Select which carrier to configure.      |
|                     | <u>Status:</u>      |                                         |
|                     | - Disabled          | The selected carrier is disabled (off). |
|                     | - Enabled           | The selected carrier is enabled (on).   |

### 2.5.12 View carrier assignments

With menu option 4G the carrier assignment can be seen, i.e. which channels are transmitted on each carrier. Note that the number of channels that can be distributed on one carrier depends on the chosen quality mode. See examples below.

```
4G Carrier 1
Ch. 04 05 06 07
```

Channels 4, 5, 6, and 7 (all Mono MQ) are assigned to carrier 1.

```
4G Carrier 4
Ch. 16 17 -- --
```

Channels 16 and 17 (both Mono MQ) are assigned to carrier 4. Room for more channels on same carrier.

```
4G Carrier 5
Ch. 18 18 19 19
```

Channels 18 and 19 (both Mono PQ) are assigned to carrier 5.

| Menu Item         | Options                                                                       | Description                                                                                                                                                              |
|-------------------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4G C.Overview ... |                                                                               | Push the button to go to the sub-menu.                                                                                                                                   |
| 4G Carrier n      | <u>Carrier nr.:</u><br>0 ... 7<br><u>Channel numbers:</u><br>-00 ... 31 or -- | Select which carrier to view.<br><br>Shows the channel numbers that are assigned to the selected carrier. The symbol '—' is used when less than 4 channels are assigned. |

### 2.5.13 Configure auxiliary inputs

The way the signals on the auxiliary inputs (Aux.-L and Aux.-R) are handled can be set in the Aux. Input Mode menu (4H).

When the option 'Stereo' is chosen, the signals on both Aux. inputs are distributed as a stereo signal to all channels. This setting can for instance be used to transmit a music signal during breaks in a conference. Note that the Transmission mode must be set to 'Aux to All' (menu item 4A) to actually transmit this stereo signal.

The 'Stereo to Mono' and 'Mono+ Emergency' options can be selected when the transmitter is used in combination with an interpretation system. The Aux. input(s) will be distributed to the Symmetrical Audio Input and Interpreters Module. In this configuration the 'floor' signal should be connected to the Aux. inputs.

| Menu Items    | Option                     | Description                                                                                                                                                                                                          |
|---------------|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4H Aux. Input | <u>Type:</u><br>* - Stereo | The Aux. inputs will be distributed in stereo to <b>all</b> channels when the transmission mode (menu item 1) is set to 'Aux to All'.                                                                                |
|               | - Stereo to Mono           | The Aux-L and Aux-R inputs are combined into a mono signal and distributed to the Symmetrical Audio Input and Interpreters Module (when present).                                                                    |
|               | - Mono + Emergency         | The Aux-L input is distributed to the Symmetrical Audio Input and Interpreters Module (when present). The Aux-R input is distributed as emergency signal to <b>all</b> channels when the emergency switch is closed. |

## 2.5.14 Set sensitivity of the inputs

The sensitivity of the audio and Aux. inputs can be set in the Input Sensitivity menus (4I, 4J, 4K). The sensitivity can be set the same for all audio inputs (menu item 4K) or for each audio input separately.

| Menu Items     | Options                                  | Value                           | Description                                                                                                                                |
|----------------|------------------------------------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| 4I Sens.Aux.L  |                                          | <u>Level:</u><br>+6 ... +18 dBV | Set the required sensitivity for the left auxiliary input.                                                                                 |
| 4J Sens.Aux.R  |                                          | <u>Level:</u><br>+6 ... +18 dBV | Set the required sensitivity for the right auxiliary input.                                                                                |
| 4K Sens.Inputs | <u>Mode:</u><br>- All<br>- Per Input ... | <u>Level:</u><br>-6 ... +6 dBV  | Set the sensitivity of all audio inputs to a user defined level.<br>Select this option to go to the 'Per Input Sensitivity Settings' menu. |

### Per Input Sensitivity settings:

| Menu Items              | Options                        | Value                         | Description                                                    |
|-------------------------|--------------------------------|-------------------------------|----------------------------------------------------------------|
| 4K Sens.Input <u>nn</u> | <u>Input nr.:</u><br>00 ... 31 | <u>Level:</u><br>-6... +6 dBV | Select which input to set and select the required sensitivity. |

The sensitivity screens also displays a level meter for a visual indication of the actual signal strength: ■ = low level, ■ = high level, ▲ = overflow.

## 2.5.15 Choose transmitter name

The transmitter can be assigned a user-defined name. This name is used in the Transmitter Status screen. The name can be edited in the Unit Name menu (4L).

| Menu Items   | Options                     | Description                                                                                            |
|--------------|-----------------------------|--------------------------------------------------------------------------------------------------------|
| 4L Unit Name | <u>Name:</u><br>- Free text | Assign a user defined name to the transmitter (max. 16 characters). The default name is 'Transmitter'. |

## 2.5.16 Enable / disable IR-monitoring

The mini IR-radiator at the front of the transmitter can be used for monitoring the IR-signal. When required (e.g. for security reasons) this option can be switched off (menu 4M).

| Menu Items       | Options                           | Description                                                             |
|------------------|-----------------------------------|-------------------------------------------------------------------------|
| 4M Mini Radiator | <u>Enabled</u> or <u>Disabled</u> | Enable or disable the mini IR-radiator at the front of the transmitter. |

### 2.5.17 Enable / disable headphone output

The headphone output at the front of the transmitter can be used for monitoring the input-and channel signals. When required (e.g. for security reasons) this option can be switched off in menu item 4N.

| Menu Items   | Options                           | Description                                                             |
|--------------|-----------------------------------|-------------------------------------------------------------------------|
| 4N Headphone | <u>Enabled</u> or <u>Disabled</u> | Enable or disable the headphone output at the front of the transmitter. |

### 2.5.18 Reset all options to factory default values

Use menu item 4O to reset all options to the factory defaults. The user defined transmitters name, the user defined language names and the transmission mode are not reset. (The default values are indicated by an asterix (\*) in the menu descriptions.)

| Menu Items      | Options                   | Description                                                                                                                                                     |
|-----------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4O Defaults ... |                           | Push the button to go to the sub-menu.                                                                                                                          |
| 4O Defaults ... | <u>Reset to defaults?</u> | Push the button to go to the sub-menu.                                                                                                                          |
|                 | * - No                    | Cancel Reset.                                                                                                                                                   |
|                 | - Yes                     | Reset all options to the factory default value.<br>The user defined transmitters name, the user defined language names and the transmission mode are not reset. |

### 3 Infra-red Radiators (LBB 4511/00 and LBB 4512/00)

#### 3.1 Description

These units accept the carrier signals generated by the transmitter and emit infra-red radiation carrying up to 32 audio distribution channels. They are connected to one or more of the four HF BNC outputs of the IR transmitter. A maximum of 30 radiators can be connected to each of these outputs by means of loop-through connections.

The LBB 4511/00 has an infra-red output of 12.5 W, while the LBB 4512/00 has an infra-red output of 25 W. Both have an automatic mains power voltage selection and are switched on automatically when the transmitter is switched on.

The attenuation of the signal by the cable is equalised automatically by the radiator. When the radiator is supplied with power and the transmitter is switched on, the radiator initialises the equalisation. The red LEDs flash for a brief period of time to indicate that the initialisation is in progress.

When not receiving carrier waves, the radiators switch to standby mode. There is also a temperature protection mode which automatically switches the radiators from full to half power or from half power to standby if the temperature of the IREDs becomes too high.

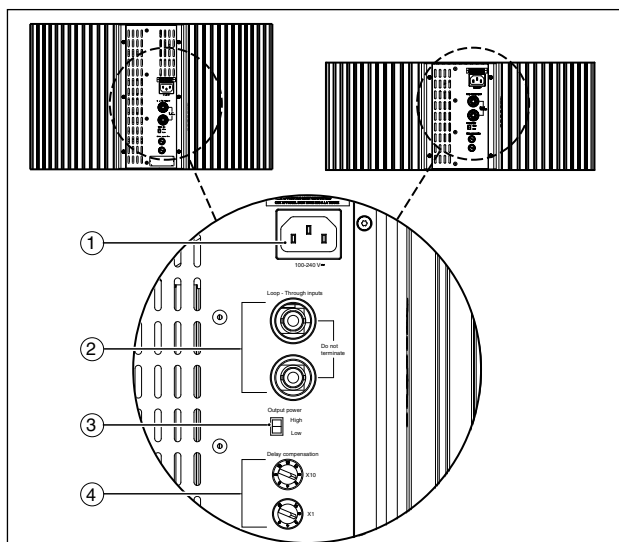


Figure 3.1 LBB 4511/00 and 4512/00 IR Radiators (back view)

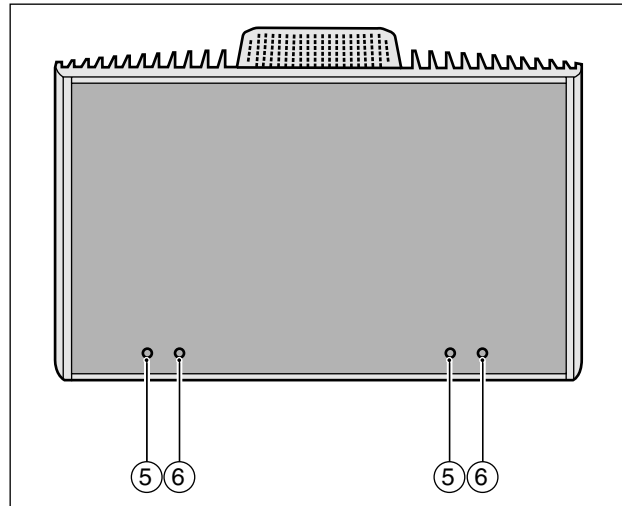


Figure 3.2 LBB 4512/00 25 W IR Radiator (front view)

#### Figure 3.1 and 3.2:

- Mains input** - Male Euro mains connector. The radiators have automatic mains voltage selection.
- IR signal input/loop-through** - Two HF BNC connectors for connecting the radiator to the transmitter and for loop-through connection to other radiators. Automatic cable termination is achieved by a built-in switch in the BNC connectors.
- Output power selection switch** - The radiators can be switched between full- and half-power operation.
- Delay compensation switches** - Two 10-position switches to compensate for differences in cable lengths to the radiators.
- Amber indicator LEDs** - Give an indication of the transmitter status.
- Red indicator LEDs** - Give an indication of the transmitter status.



**Note:** The indicator LEDs are positioned behind the semi-transparent cover and are only visible when ON.

## 3.2 Radiator status indication

A radiator consists of two IRED panels. Each IRED panel has an amber and a red indicator LED (see figure 3.2) which show the status of the radiator panel:

| Red LED  | Amber LED | Status                                                                                                                                       |
|----------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------|
| on       | off       | Stand-by mode                                                                                                                                |
| off      | on        | Transmitting                                                                                                                                 |
| flashing | on        | At switch-on:<br>Initialising signal equalisation<br>During operation:<br>Temperature protection mode.<br>See chapter 6,<br>Trouble-shooting |
| on       | on        | IRED panel failure.<br>See chapter 6,<br>Trouble-shooting                                                                                    |

## 3.3 Mounting the radiators

Radiators in permanent installations can be either fixed to a wall, hung under a ceiling or balcony or secured to any sturdy material, using the suspension bracket supplied with the radiator. The mounting angle can be adjusted for optimal coverage.

For wall mounting a separate bracket (LBB 3414/00) is also required. In non-permanent installations, a floor stand can be used.



**Note:** When in operation, the radiators may feel warm to the touch. This is quite normal, and does not indicate a radiator fault or malfunction.



**Warning:** Always ensure that natural air-flow is not obstructed by ceilings, walls etc. when determining the position of the radiator. Leave plenty of space around the radiator to prevent it becoming too hot.

### Attaching the suspension bracket

First assemble the supplied suspension bracket and connect it to the radiator (see figure 3.3 and figure 3.4). This bracket is attached to the radiator by two bolts with washers. There are corresponding holes on the back of the radiators. There is also a spring-loaded plunger (indicated by a black arrow in figure 3.4), located above the bolt hole on the right-hand arm of the bracket, which is used for adjusting the angle of the radiator (shown in inset in figure 3.4). There are corresponding holes on the back of the radiator for accepting this plunger. The mounting angle can be adjusted in steps of 15°.

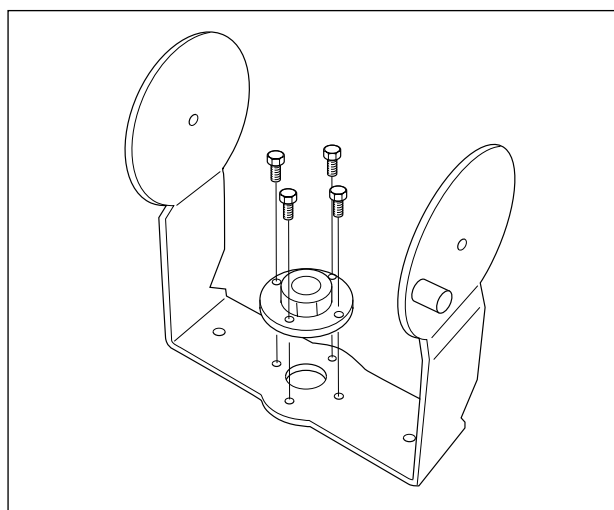


Figure 3.3 Attaching the plate to the suspension bracket

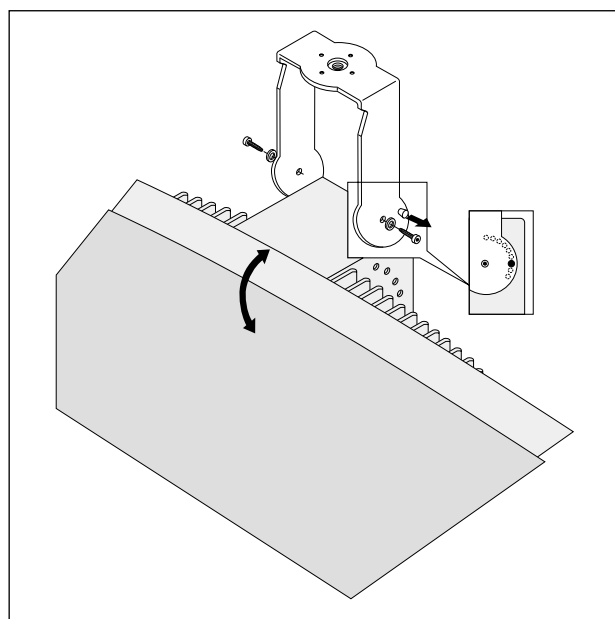


Figure 3.4 Attaching the suspension bracket to the radiator

### Mounting on a floor stand

The top of the floor stand is screwed into the suspension bracket (figure 3.5). The bracket is supplied with both metric and Whitworth threaded plates, and is therefore compatible with most standard floor stands. For floor stands, the mounting angle can be set at 0°, 15° or 30°.

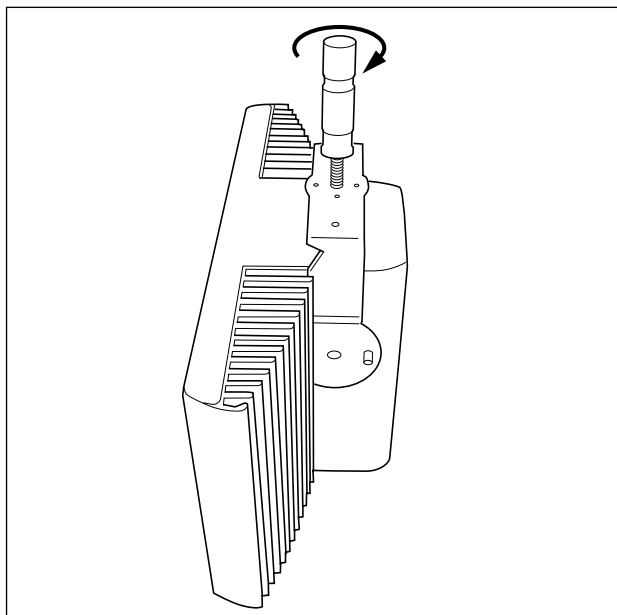


Figure 3.5 Attaching the stud of a floor stand to the suspension bracket of the radiator

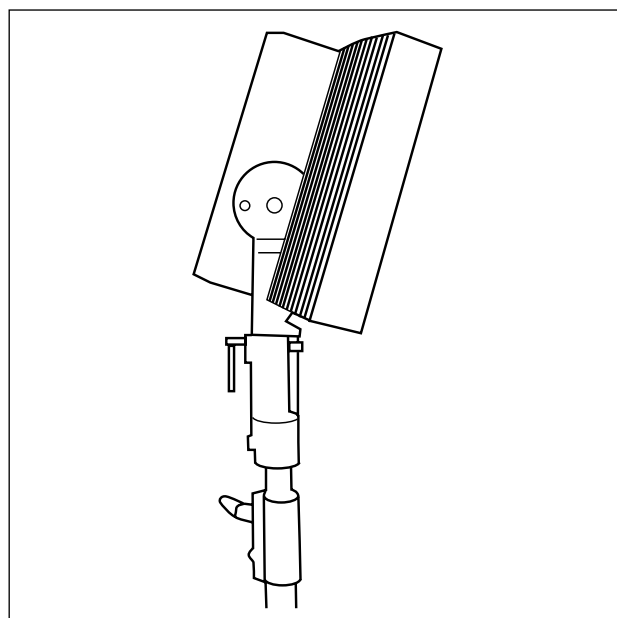


Figure 3.6 Attaching the radiator inclusive suspension bracket and stud to the floor stand

### Wall mounting

For wall mounting, an extra wall bracket (LBB 3414/00) is required (must be ordered separately). This bracket is attached to the wall by means of four bolts (see figure 3.8). Four holes of 10 mm in diameter and 60 mm in depth must be drilled using the drilling pattern (see figure 3.7).



**Note:** The four bolts used to attach the bracket must each be able to withstand a pull-out force of 200 kg (440 lb). The bolts and plugs delivered with the LBB 3414/00 wall bracket are only intended for mounting the unit on a solid brick or concrete wall.

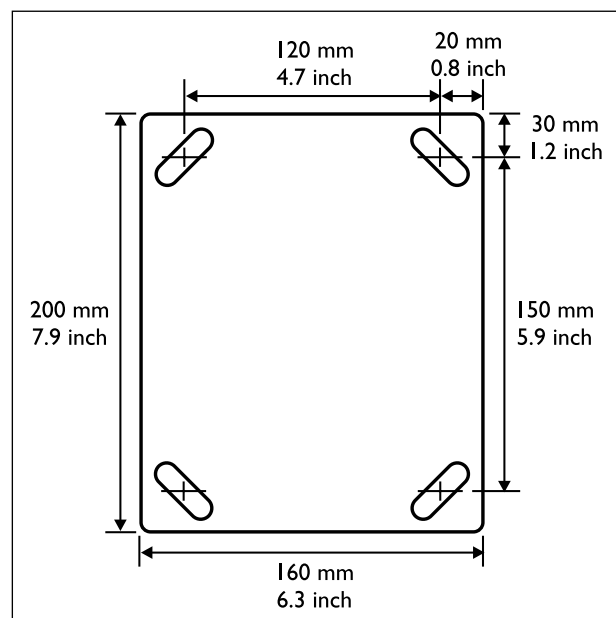


Figure 3.7 LBB 3414/00 wall mounting bracket showing dimensions and drilling pattern

The radiator (plus suspension bracket) is attached to the wall bracket by sliding the mounting bolt over the slot on the wall bracket and then tightening it (see figure 3.9). A split pin is then inserted into a small hole in the bolt to stop it from working loose (see inset in figure 3.9). The vertical angle of the radiator can be adjusted between 0 and 90° in steps of 15°. The horizontal orientation of the radiator can be adjusted by loosening the bolt then turning the radiator to the required position.

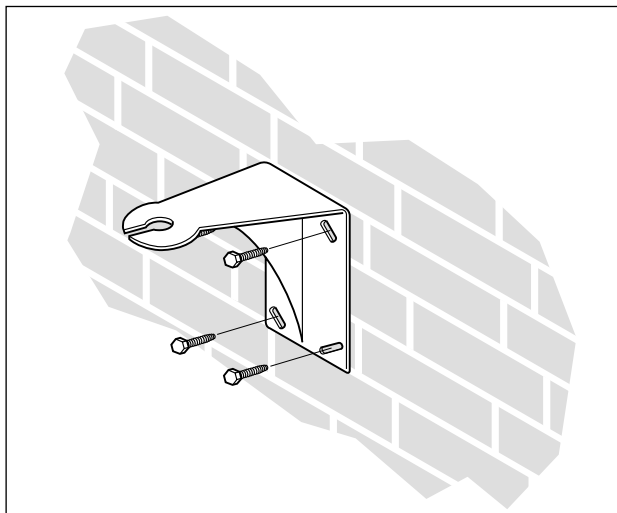


Figure 3.8 Attaching the wall mounting bracket to a wall

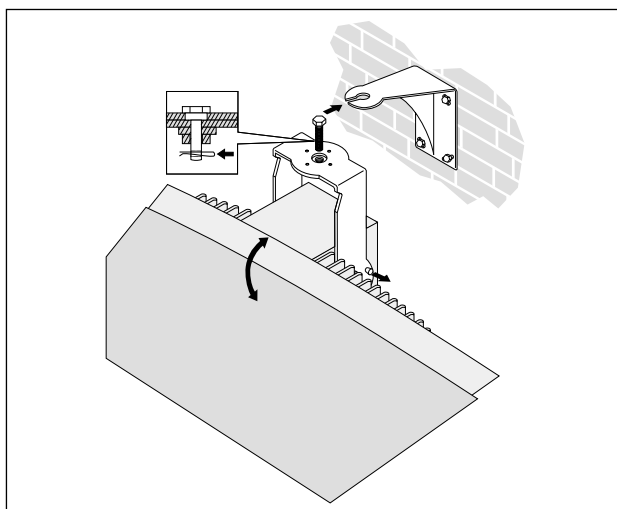


Figure 3.9 Attaching the radiator to the wall mounting bracket

### Ceiling mounting

The radiators can be attached to the ceiling using the supplied suspension bracket. This ensures enough space for a proper air flow around the radiator.

Mounting a radiator **in** the ceiling will in most cases require a forced air flow by means of a ventilator to prevent overheating.

### Mounting on horizontal surfaces

When the radiator has to be positioned a horizontal surface (e.g. on top of an interpreter booth), the distance between the radiator and the surface must be at least 4 cm (1.5 inch) to enable enough air flow around the radiator. This can be achieved by using the suspension bracket as a support. If this is not possible, switch the radiator to half power. If the radiator is used at full power on top of an interpreter booth, the ambient temperature must not exceed 35° C.

## 3.4 Connecting radiators to the transmitter

The transmitter has four BNC HF Output connectors labelled 1, 2, 3 and 4 on the rear panel. All four outputs are functionally identical. They can each drive up to 30 radiators (LBB 4511 and/or 4512) in a loop-through configuration. The radiators are connected with RG59 cables. The maximum cable length per output is 750 m (2460 ft) to the last radiator. Automatic cable termination is achieved by a built-in switch in the BNC connectors on the radiator.



#### Notes:

- For the automatic cable termination to work, never leave an open-ended cable connected to the last radiator in a loop-through chain.
- When connecting infra-red radiators, do not split the cable, else the system will not function correctly.

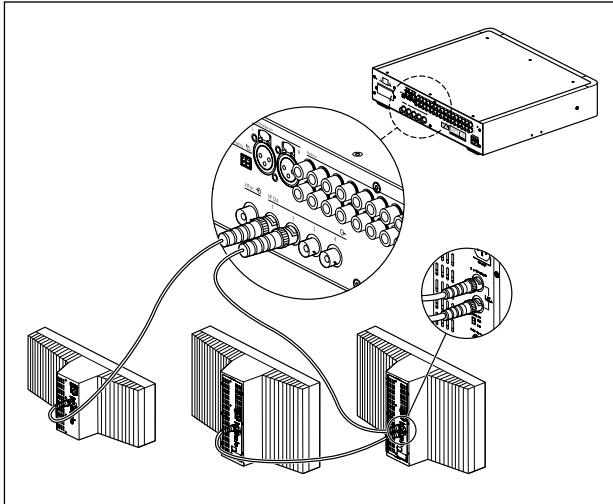


Figure 3.10 Loop-through connection of LBB 4511 and/or LBB 4512 IR Radiators

### 3.5 Using the output power selection switch

The radiators can be switched to half power. This can be used when full power is not required, e.g. when a mobile system is used in a small conference venue. Also switch a radiator to half power when an adequate air flow can not be guaranteed, e.g. when the radiator is mounted on top of an interpreters booth. Reducing the power when possible saves energy and increases the lifetime.

## 4 Infra-Red Receivers (LBB 4540/xx)

### 4.1 Description

Receivers are available for 4 or 32 channels. They can operate with a rechargeable NiMH battery pack or with disposable batteries and have controls for channel selection, volume adjustment and an on/off push button. All receivers have a 3.5 mm (0.14 inch) stereo jack output socket for mono or stereo headphones.

An LCD display shows the channel number and indicators for signal reception and low battery power.

Charging circuitry is included in the receiver.

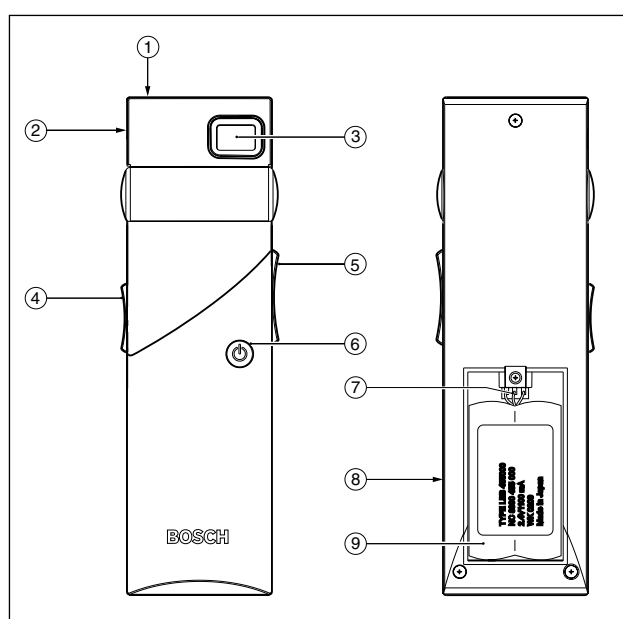


Figure 4.1 Receiver, front view and back view with open battery compartment

#### Figure 4.1:

1. **Charging indicator LED** - Used in combination with the charging equipment.
2. **Headphone connector** - A 3.5 mm (0.14 inch) stereo jack output socket for the headphone, with integrated Stand-by/Off-switch.
3. **LCD Display** - A two digit display showing the selected channel. An antenna symbol is visible when the receiver picks up an infra red signal of adequate quality. A battery symbol is visible when the battery pack or the batteries are almost empty.

4. **Volume control** - A slider to adjust the volume.
5. **Channel selector** - An up/down switch to select an audio channel. The channel number is shown on the LCD display.
6. **On/Off button** - When a headphone is connected, the receiver switches to Stand-by state. Pressing the On/Off button switches the receiver from Stand-by to On. To switch back to Stand-by, press and hold the button for approx. 2 seconds. When the headphone is removed, the receiver switches automatically to the Off-state.
7. **Battery pack connector** - This connection is used to connect the battery pack to the receiver. Charging is automatically disabled when this connector is not used.
8. **Charging contacts** - Used in combination with the charging equipment to recharge the battery pack (if used).
9. **Battery pack or disposable batteries** - Either a rechargeable NiMH battery pack (LBB 4550/00) or two disposable AA-size 1.5V batteries.



**Note:** When the receiver is not used, disconnect the headphones. This ensures that the receiver is totally switched-off and no energy is consumed from the batteries or the battery pack.

## 4.2 Operation

The receiver cannot operate when no headphone is connected. After connecting the headphone the receiver switches to stand-by mode. Push shortly on the on/off button to switch the receiver on.

The channel number is shown on the LCD display. The channel can be changed with the channel selector. Push it to the up- or down-position to increase or decrease the channel number. The highest channel number is automatically matched to the number of channels that has been set on the transmitter (see section 2.5.8).

A battery symbol is visible on the display when the batteries or the battery pack is almost empty.

An antenna symbol is visible when the receiver picks up a modulated infra red signal of adequate quality.

During short interruptions in the reception, the receiver mutes the headphones output. When no adequate IR signal is detected for more than 1 minute (e.g. when a delegate leaves the conference room), the receiver automatically switches to stand-by mode.

The volume can be changed by moving the volume control up or down.

The receiver can be manually switched to stand-by mode by pressing the on/off button for more than 2 seconds.

When the headphone is disconnected, the receiver is automatically switched off. (A switch in the headphone connector disconnects the batteries.)

The infra-red receivers can operate with disposable batteries (2x AA-size alkaline cells) or with a rechargeable battery pack (LBB 4550/00).

Insert the batteries or the battery pack in the receiver with the correct polarity as indicated in the battery compartment. The battery pack has a separate connection cable which must be connected to the receiver.

When this connection is not present, the charging circuitry in the receiver will not work. This also prevents the unwanted charging of disposable batteries. The battery pack has a temperature sensor which prevents overheating during charging.

For more information about charging the battery pack see chapter 5.



**Note: Disposable batteries and battery packs at the end of their technical lives should be discarded with due care for the environment. When possible, take batteries to a local recycling station.**

## 4.3 Reception test mode

The receivers can be switched to a test-mode to get an indication of the reception quality for each carrier separately.

To activate the test-mode: Push the channel selector to the Up-position, press the on/off button and hold both for ca. 2 seconds. When in test-mode, switch between carriers by using the channel selector. The receiver's display will shortly show the carrier number (1-8) and then a quality indication (00-99). The reception quality can be assessed as follows:

| Indication | Quality                                  |
|------------|------------------------------------------|
| 00-39      | Good reception. Very good audio quality. |
| 40-49      | Weak reception. Ticks in the audio.      |
| 50-99      | No or bad reception. Poor audio quality. |

The test mode is deactivated when the receiver is switched off.

## 4.4 Receiver headphones

The headphones connect with the receivers via a 3.5 mm (0.14 inch) stereo jack connector. Suitable headphone types are:

LBB 3441/00 Under the chin mono headphones

LBB 3442/00 Single earphone (mono)

LBB 3443/00 Stereo headphones (recommended)

Or any other compatible type (see chapter 7, Technical Data).

## 5 Charging Units (LBB 4560/xx)

### 5.1 Description

The charging units can recharge up to 56 receivers at once. The charging unit contains the power supply with automatic mains voltage selection. The charging electronics and a charging indicator LED are included in each receiver. The charging circuitry checks if a battery pack is present and controls the charging process.



**Note:** These charging units are only intended to charge LBB 4540/xx receivers with a LBB 4550/00 battery pack. You cannot charge other receiver types with the LBB 4560/xx charging units, nor can you use other charging units to charge LBB 4540/xx receivers.

Two versions are available, which are functionally identical:

- LBB 4560/00 Charging suitcase for portable systems.
- LBB 4560/50 Charging cabinet for permanent systems. Suitable for either table-top or wall-mounted use.

**Figure 5.1:**

1. **Mains input** - Male Euro mains socket. The charging unit has automatic mains voltage selection. A mains cable is provided.
2. **Mains on/off switch**
3. **Receiver positions** - One charging unit can charge up to 56 receivers simultaneously.

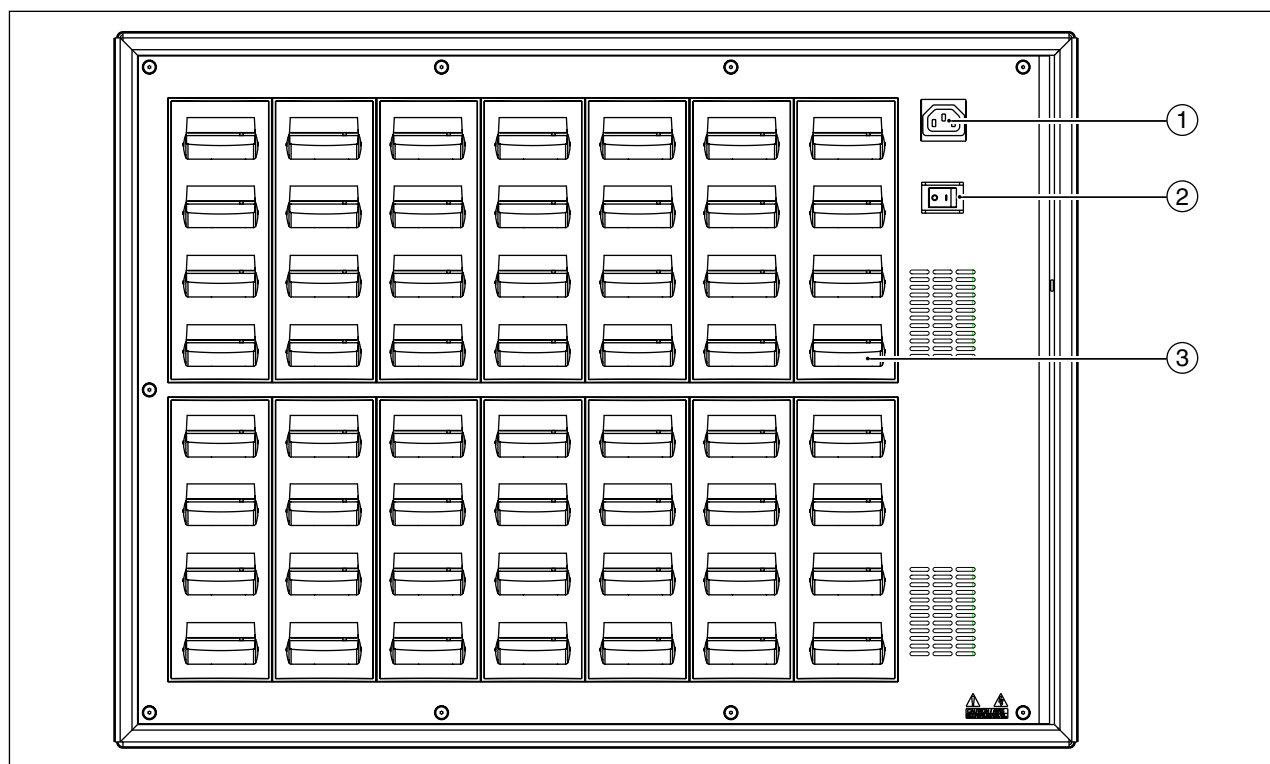


Figure 5.1 LBB 4560/xx Charging unit

## 5.2 Wall mounting the charging cabinet

LBB 4560/50 is suitable for either table-top or wall-mounted use.

It can be wall-mounted using 5 mm (0.19 inch) screws, with a head diameter of 9 mm (0.35 inch). The screws and plugs delivered with the LBB 4560/50 are designed to mount the unit on a solid brick or concrete wall. Two holes, 8 mm in diameter and 55 mm in depth, must be drilled 500 mm apart (see figure 5.2).



**Warning:** To comply with UL and CSI regulations, the charging cabinets must be mounted in such a way that they can be easily removed by hand in case of emergency.

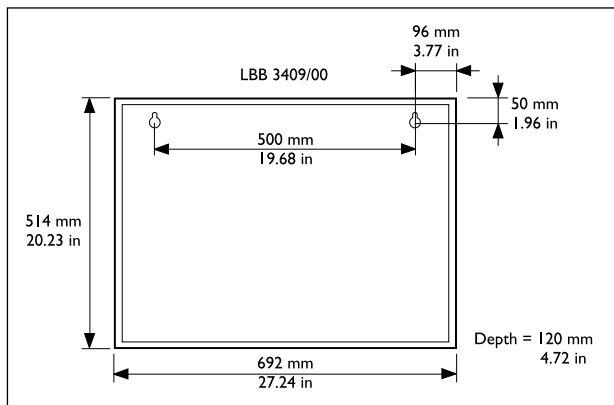


Figure 5.2 Charging cabinet mounting dimensions

## 5.3 Charging procedure

Ensure that the charging unit is connected to the mains and that it is switched on. Place the receivers firmly in the charging compartments. The charging indicator LEDs on all receivers should illuminate. These LEDs indicate the charging status of each receiver:

| LED colour   | Charging status                                         |
|--------------|---------------------------------------------------------|
| Green        | Charging completed.                                     |
| Red          | Charging in progress.                                   |
| Red blinking | Error status. See chapter 6, Trouble-shooting.          |
| Off          | Charger switched off or receiver not properly inserted. |



### Notes:

- It is preferred to switch on the charging unit before inserting the receivers. Receivers can be inserted or removed without damage while the charging unit is switched on.
- Charge the battery pack to full capacity before using them for the first time.
- The charger always applies fast charge during the first 10 minutes after inserting a receiver. Inserting the receiver multiple times with a fully charged battery pack should therefore be avoided, as this will damage the battery pack.
- Continuously charging the receiver will not damage the receiver or battery pack. Receivers can therefore safely be left in their charging positions when they are not used.
- When the rechargeable battery pack is used, it is advisable to check regularly after three years that the batteries are not leaking. If there is any sign of leakage or corrosion, replace the battery pack. Ensure that only the battery pack LBB 4550/00 is used. The battery pack has to be replaced at least every five years.

## 6 Troubleshooting

In this chapter a simple fault-finding guide is given. This is intended to be used to remedy the consequences of incorrect installation. If more serious faults or problems arise the installer should contact a qualified technician.

| Problem                                                                                  | Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Transmitter display does not light up:                                                   | <ul style="list-style-type: none"> <li>Check that the mains supply to the transmitter is connected and that the transmitter is switched on.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Transmitter indicates "no radiators":                                                    | <ul style="list-style-type: none"> <li>Ensure that connections to all radiators have been made correctly and that each radiator's mains supply is connected and switched on.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Transmitter indicates "radiator fault":                                                  | <ul style="list-style-type: none"> <li>Ensure that connections to all radiators have been made correctly and that each radiator's mains supply is connected and switched on.</li> <li>Examine the radiator LEDs.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Transmitter does not synchronise automatically to the maximum number of channels in DCN: | <ul style="list-style-type: none"> <li>Ensure that the number of channels is set to automatic (using menu item 4B).</li> <li>Check whether a DCN interface module of version 01.05 or higher is used.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Emergency contact does not work:                                                         | <ul style="list-style-type: none"> <li>Check that the emergency contact is connected correctly.</li> <li>Check that the auxiliary input mode is set to 'Mono + Emergency' (using menu item 4H).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Red LED flashes and amber LED is on of one or both IRED panels of a radiator:            | <ul style="list-style-type: none"> <li>IRED panel is in temperature protection mode. Check that the natural airflow around that radiator is not obstructed. If not so, replace the radiator.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Both red LED and amber LED are on of one or both IRED panels of a radiator:              | <ul style="list-style-type: none"> <li>IRED panel malfunctions and the radiator should be replaced.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Infra red receiver fails to function properly:                                           | <ul style="list-style-type: none"> <li>If disposable batteries are used, check whether the batteries have sufficient capacity and whether they are inserted with the correct polarity.</li> <li>If a battery pack is used, ensure that the battery pack is fully charged.</li> <li>Ensure that the headphone is connected properly.</li> <li>Switch the receiver on and check whether the display indicates a channel.</li> <li>Ensure that the receiver picks up sufficient IR signal and check whether the antenna symbol becomes visible.</li> <li>Check the receiver by holding it in front of the mini radiator of the transmitter.</li> <li>Ensure that the volume control is turned up.</li> <li>Set the transmitter in test mode and check whether the test tone is audible on the receiver.</li> <li>If the test tone is not audible, do the same test with other receivers. If all receivers do not work properly at that spot, check the coverage of the system (see section 1.6).</li> </ul> |
| The charging indicator LED on the receiver is blinking:                                  | <ul style="list-style-type: none"> <li>Check that the charging unit is used under the specified working conditions (see technical data).</li> <li>Check that the receiver contains a battery pack which is connected correctly.</li> <li>Ensure that the receiver is at room temperature and re-insert the receiver in the charging unit.</li> <li>If the charging indicator starts blinking again, replace the battery pack and check whether the problem is resolved.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Receiver discharges very quickly:                                                        | <ul style="list-style-type: none"> <li>Replace the battery pack and check whether the problem is resolved.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Bad coverage:                                                                            | <ul style="list-style-type: none"> <li>Do the tests as described in section 1.6.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

## 7 Technical Data

### 7.1 System Specification

#### Overall system characteristics

- Conforms to IEC 60914, the international standard for conference systems
- Conforms to IEC 61603 part 7, the international standard for digital infra-red transmission of audio signals for conference and similar applications

#### Transmission Characteristics

|                                   |                                                                                                |
|-----------------------------------|------------------------------------------------------------------------------------------------|
| IR transmission wavelength        | 870 nm                                                                                         |
| Modulation frequency              | Carriers 0 to 5: 2 to 6 MHz,<br>according to IEC 60603 part 7<br>Carriers 6 and 7: up to 8 MHz |
| Protocol and modulation technique | DQPSK, according to IEC 60603 part 7                                                           |

#### System Audio Performance

(Measured from the audio input of an LBB 4502 transmitter to the headphone output of an LBB 4540 receiver.)

|                                    |                                                                                                 |
|------------------------------------|-------------------------------------------------------------------------------------------------|
| Audio frequency response           | 20 Hz to 10 kHz (-3 dB) at<br>Standard Quality<br>20 Hz to 20 kHz (-3 dB) at<br>Premium Quality |
| Total harmonic distortion at 1 kHz | < 0.05%                                                                                         |
| Crosstalk attenuation at 1 kHz     | > 80 dB                                                                                         |
| Dynamic range                      | > 80 dB                                                                                         |
| Weighted signal-to-noise ratio     | > 80 dB(A)                                                                                      |

#### Cabling and System Limits

|                             |                     |
|-----------------------------|---------------------|
| Cable type                  | 75 Ohm RG59         |
| Maximum number of radiators | 30 per HF output    |
| Maximum cable length        | 900 m per HF output |

#### System Environmental Conditions

|                            |                                                                                                                                                                                 |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Working conditions         | Fixed/stationary/transportable                                                                                                                                                  |
| Temperature range          | -40 to +70 °C (-40 to 158 °F)<br>+5 to +45 °C (41 to 113 °F)<br>+5 to +35 °C (41 to 122 °F)<br>for LBB 4560<br>+5 to +55 °C (41 to 131 °F) for<br>LBB 4502                      |
| Maximum relative humidity  | < 93%                                                                                                                                                                           |
| Safety                     | According to EN 60065,<br>CAN/CSA-E65 (Canada and<br>US) and UL 6500<br>According to EN 60065,<br>CAN/CSA-E65 (Canada and<br>US) and UL 1419 for LBB<br>4511/00 and LBB 4512/00 |
| EMC emission               | According to harmonized stan-<br>dard EN 55103-1 and FCC rules<br>part 15, complying with the limits<br>for a class A digital devices                                           |
| EMC immunity               | According to harmonized<br>standard EN 55103-2                                                                                                                                  |
| EMC approvals              | Affixed with the CE mark                                                                                                                                                        |
| ESD                        | According to harmonized<br>standard EN 55103-2                                                                                                                                  |
| Mains harmonics            | According to harmonized<br>standard EN 55103-1                                                                                                                                  |
| Environmental requirements | Contains no banned substances<br>as specified in UAT-0480/100<br>(e.g. no cadmium or asbestos)                                                                                  |

## 7.2 Transmitters and Modules

### 7.2.1 LBB 4502/xx Infra Red Transmitters

#### Physical Characteristics

|                        |                                                                                                                                                                             |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mounting               | Brackets for 19" rack mounting or fixing to a table top<br>Detachable feet for free-standing use on a table top                                                             |
| Dimensions (H x W x D) | 88 x 483 x 350 mm (35 x 190 x 138 in) for 19" rack use, with brackets, without feet<br>92 x 440 x 350 mm (36 x 190 x 138 in) for table top use, without brackets, with feet |
| Weight                 | 6.7 kg (14.7 lbs) with brackets, without feet<br>6.8 kg (15.0 lbs) without brackets, with feet                                                                              |
| Finish                 | Charcoal with silver                                                                                                                                                        |

#### Electrical Characteristics

|                             |                                       |
|-----------------------------|---------------------------------------|
| Asymmetrical audio inputs   | -6 to +6 dBV nominal                  |
| Symmetrical audio inputs    | +6 to +18 dBV nominal                 |
| Emergency switch connector  | emergency control input               |
| Headphone output            | 32 Ohm to 2 kOhm                      |
| HF input                    | nominal 1Vpp, minimum 10 mVpp, 75 Ohm |
| HF output                   | 1 Vpp, 6 VDC, 75 Ohm                  |
| Mains voltage               | 90 to 260 V, 50 to 60 Hz              |
| Power consumption           | maximal 55 W                          |
| Power consumption (standby) | 29 W                                  |

### 7.2.2 LBB 3423/00 DCN Interface Module

#### Physical Characteristics

|                        |                                                            |
|------------------------|------------------------------------------------------------|
| Mounting               | Front panel is removed when used with LBB 4502 Transmitter |
| Dimensions (H x W x D) | 100 x 26 x 231 mm (39 x 10 x 91 in) without front panel    |
| Weight                 | 312 g (0.69 lb) without front panel                        |

#### Electrical Characteristics

See DCN data brochure.

## 7.3 Radiators and Accessories

### 7.3.1 LBB 4511/00 and LBB 4512/00 Radiators

#### Physical Characteristics

|                        |                                                                                                                                                                                                          |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mounting               | Suspension bracket for direct ceiling mounting<br>Mounting plates for floor stands with M10 and 1/2" Whitworth thread LBB 3414/00 Wall Mounting Bracket can be used for fixing radiator to wall surfaces |
| Dimensions (H x W x D) | LBB 4511/00 without bracket: 200 x 500 x 175mm (7.9 x 19.7 x 6.9 in)<br>LBB 4512/00 without bracket: 300 x 500 x 175mm (11.0 x 19.7 x 6.9 in)                                                            |
| Radiator angle         | 0, 15 and 30° for floor-stand mounting<br>0, 15, 30, 45, 60, 75 and 90° for wall/ceiling mounting.                                                                                                       |
| Weight                 | LBB 4511/00 without bracket: 6.8 kg (15 lbs)<br>LBB 4511/00 with bracket: 7.6 kg (17 lbs)<br>LBB 4512/00 without bracket: 9.5 kg (21 lbs)<br>LBB 4512/00 with bracket: 10.3 kg (23 lbs)                  |
| Finish                 | Bronze coloured                                                                                                                                                                                          |

#### Electrical and Optical Characteristics

|                              |                                                           |
|------------------------------|-----------------------------------------------------------|
| Number of IREs               | 260 (LBB 4511/00), 480 (LBB 4512/00)                      |
| Total IR output at 20 °C     | 8 Wrms 16 Wpp (LBB 4511/00), 16 Wrms 32 Wpp (LBB 4512/00) |
| Total optical peak intensity | 9 W/sr (LBB 4511/00), 18 W/sr (LBB 4512/00)               |
| Angle of half intensity      | +/- 22°                                                   |
| HF input                     | nominal 1Vpp, minimal 10 mVpp                             |
| HF output                    | 1 Vpp, 6 VDC, 75 Ohm                                      |
| Mains voltage                | 90 to 260 V, 50 to 60 Hz                                  |
| Power consumption            | 100 W (LBB 4511/00), 180 W (LBB 4512/00)                  |
| Power consumption (standby)  | 8 W (LBB 4511/00), 10 W (LBB 4512/00)                     |

## 7.3.2 LBB 3414/00 Wall Mounting Bracket

### Physical characteristics:

Dimensions (H x W x D) 200 x 280 x 160 mm  
(7.9 x 11.0 x 6.3 in)

Weight 1.8 kg (4.0 lb)

Finish Quartz grey

## 7.4 Receivers, Battery Packs and Charging Units

### 7.4.1 LBB 4540 Pocket Receivers

#### Physical Characteristics

Dimensions (H x W x D) 155 x 45 x 30 mm (6.1 x 1.8 x 1.2 in)

Weight excl. batteries/battery pack 75 g (0.16 lb)

Weight incl. battery pack 125 g (27 lb)

Finish Charcoal with silver

#### Electrical and Optical Characteristics

IR irradiance level 4 mW/m<sup>2</sup> per carrier

Angle of half sensitivity +/-50°

Headphone output level at 2.4V 450 mVrms (speech at maximum volume, 32 Ohm headphone)

Headphone output freq. range 20 Hz to 20 kHz

Headphone output impedance 32 Ohm to 2 kOhm

Max. signal-to-noise ratio > 80 dB(A)

Supply voltage 1.8 to 3.6 V, nominal 2.4 V

Power consumption at 2.4 V 15 mA (speech at maximum volume, 32 Ohm headphone)

Power consumption (standby) < 1 mA

### 7.4.2 LBB 4550/00 NiMH Battery Pack

#### Physical characteristics:

Dimensions (H x W x D) 14 x 28 x 49 mm  
(5.5 x 11 x 19 in)

Weight 50 g (11 lb)

#### Electrical characteristics:

Voltage 2.4 V

Capacity 1100 mAH

## 7.4.3 LBB 4560 Charging Units

### Physical Characteristics

Mounting LBB 4560/50: screws and plugs for wall mounting included

Dimensions (H x W x D) LBB 4560/00: 230 x 690 x 530 mm (9 x 27 x 21 in)  
LBB 4560/50: 130 x 680 x 520 mm (5 x 27 x 20 in)

Weight excl. receivers LBB 4560/00: 15.5 kg (34 lbs)

LBB 4560/50: 11.2 kg (25 lbs)

Weight incl. 56 receivers LBB 4560/00: 22.3 kg (49 lbs)

LBB 4560/50: 18.0 kg (40 lbs)

Finish Charcoal with grey

### Electrical Characteristics

Mains voltage 90 to 260 V, 50 to 60 Hz

Power consumption 270 W (56 receivers charging)

Power consumption (standby) 7 W (no receivers in the charging unit)

## 7.5 Connection details

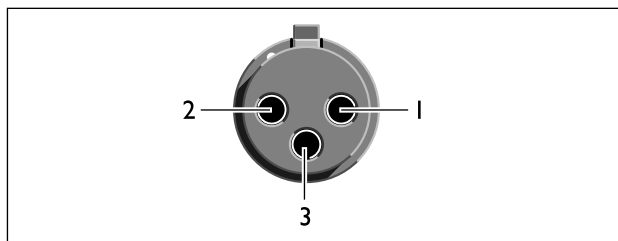
### 7.5.1 Mains cables

|              |              |
|--------------|--------------|
| Blue         | Neutral      |
| Brown        | Live         |
| Green/Yellow | Earth/Ground |

### 7.5.2 Audio cables

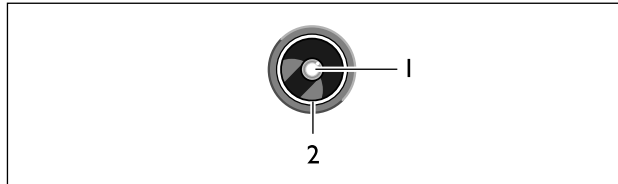
#### 3-pole XLR connector (female)

|       |          |
|-------|----------|
| Pin 1 | Earth    |
| Pin 2 | Signal + |
| Pin 3 | Signal - |



#### Chinch connector (male)

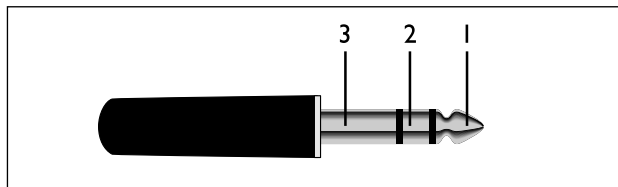
|       |          |
|-------|----------|
| Pin 1 | Signal + |
| Pin 2 | Signal - |



### 7.5.3 Earphones

#### 3.5 mm Jack plug

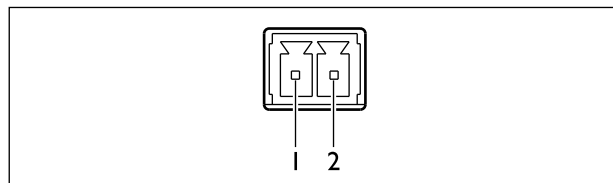
|            |                         |
|------------|-------------------------|
| Tip (1)    | Signal left             |
| Ring (2)   | Signal Right            |
| Sleeve (3) | Electrical earth/screen |



### 7.5.4 Emergency switch

#### Terminal block

Connect the emergency switch to pin 1 and 2



## 7.6 Guaranteed rectangular footprints

|                    |                     |                          | LBB 4511/00 at full power |              |             |              | LBB 4512/00 at full power |              |             |              |
|--------------------|---------------------|--------------------------|---------------------------|--------------|-------------|--------------|---------------------------|--------------|-------------|--------------|
| number of carriers | mounting height [m] | mounting angle [degrees] | area A [m <sup>2</sup> ]  | length L [m] | width W [m] | offset X [m] | area A [m <sup>2</sup> ]  | length L [m] | width W [m] | offset X [m] |
| 1                  | 2.5                 | 0                        | 627                       | 33           | 19          | 7            | 1269                      | 47           | 27          | 10           |
|                    | 5                   | 15                       | 620                       | 31           | 20          | 7            | 1196                      | 46           | 26          | 8            |
|                    |                     | 30                       | 468                       | 26           | 18          | 4            | 816                       | 34           | 24          | 6            |
|                    |                     | 45                       | 288                       | 18           | 16          | 2            | 480                       | 24           | 20          | 2            |
|                    |                     | 60                       | 196                       | 14           | 14          | 0            | 324                       | 18           | 18          | 0            |
|                    |                     | 90                       | 144                       | 12           | 12          | -6           | 196                       | 14           | 14          | -7           |
|                    | 10                  | 15                       | 589                       | 31           | 19          | 9            | 1288                      | 46           | 28          | 10           |
|                    |                     | 30                       | 551                       | 29           | 19          | 5            | 988                       | 38           | 26          | 6            |
|                    |                     | 45                       | 414                       | 23           | 18          | 2            | 672                       | 28           | 24          | 2            |
|                    |                     | 60                       | 306                       | 18           | 17          | -1           | 506                       | 23           | 22          | -1           |
|                    |                     | 90                       | 256                       | 16           | 16          | -8           | 400                       | 20           | 20          | -10          |
|                    | 20                  | 30                       | 408                       | 24           | 17          | 13           | 1080                      | 40           | 27          | 11           |
|                    |                     | 45                       | 368                       | 23           | 16          | 7            | 945                       | 35           | 27          | 4            |
|                    |                     | 60                       | 418                       | 22           | 19          | 1            | 754                       | 29           | 26          | -1           |
|                    |                     | 90                       | 324                       | 18           | 18          | -9           | 676                       | 26           | 26          | -13          |
| 2                  | 2.5                 | 15                       | 308                       | 22           | 14          | 4            | 576                       | 32           | 18          | 6            |
|                    | 5                   | 15                       | 322                       | 23           | 14          | 5            | 620                       | 31           | 20          | 7            |
|                    |                     | 30                       | 247                       | 19           | 13          | 3            | 468                       | 26           | 18          | 4            |
|                    |                     | 45                       | 168                       | 14           | 12          | 1            | 288                       | 18           | 16          | 2            |
|                    |                     | 60                       | 132                       | 12           | 11          | -1           | 196                       | 14           | 14          | 0            |
|                    |                     | 90                       | 100                       | 10           | 10          | -5           | 144                       | 12           | 12          | -6           |
|                    | 10                  | 30                       | 266                       | 19           | 14          | 6            | 551                       | 29           | 19          | 5            |
|                    |                     | 45                       | 234                       | 18           | 13          | 2            | 414                       | 23           | 18          | 2            |
|                    |                     | 60                       | 195                       | 15           | 13          | -1           | 306                       | 18           | 17          | -1           |
|                    |                     | 90                       | 144                       | 12           | 12          | -6           | 256                       | 16           | 16          | -8           |
|                    | 20                  | 60                       | 195                       | 15           | 13          | 3            | 418                       | 22           | 19          | 1            |
|                    |                     | 90                       | 196                       | 14           | 14          | -7           | 324                       | 18           | 18          | -9           |
| 4                  | 2.5                 | 15                       | 160                       | 16           | 10          | 3            | 308                       | 22           | 14          | 4            |
|                    | 5                   | 15                       | 144                       | 16           | 9           | 4            | 322                       | 23           | 14          | 5            |
|                    |                     | 30                       | 140                       | 14           | 10          | 3            | 247                       | 19           | 13          | 3            |
|                    |                     | 45                       | 99                        | 11           | 9           | 1            | 168                       | 14           | 12          | 1            |
|                    |                     | 60                       | 90                        | 10           | 9           | -1           | 132                       | 12           | 11          | -1           |
|                    |                     | 90                       | 64                        | 8            | 8           | -4           | 100                       | 10           | 10          | -5           |
|                    | 10                  | 45                       | 120                       | 12           | 10          | 3            | 234                       | 18           | 13          | 2            |
|                    |                     | 60                       | 108                       | 12           | 9           | 0            | 195                       | 15           | 13          | -1           |
|                    |                     | 90                       | 100                       | 10           | 10          | -5           | 144                       | 12           | 12          | -6           |
|                    | 20                  | 90                       | 64                        | 8            | 8           | -4           | 196                       | 14           | 14          | -7           |
| 8                  | 2.5                 | 15                       | 84                        | 12           | 7           | 2            | 160                       | 16           | 10          | 3            |
|                    | 5                   | 15                       | 60                        | 10           | 6           | 4            | 144                       | 16           | 9           | 4            |
|                    |                     | 30                       | 70                        | 10           | 7           | 3            | 140                       | 14           | 10          | 3            |
|                    |                     | 45                       | 63                        | 9            | 7           | 1            | 99                        | 11           | 9           | 1            |
|                    |                     | 60                       | 49                        | 7            | 7           | 0            | 90                        | 10           | 9           | -1           |
|                    |                     | 90                       | 36                        | 6            | 6           | -3           | 64                        | 8            | 8           | -4           |
|                    | 10                  | 60                       | 49                        | 7            | 7           | 2            | 108                       | 12           | 9           | 0            |
|                    |                     | 90                       | 49                        | 7            | 7           | -3.5         | 100                       | 10           | 10          | -5           |

(The mounting height is the distance from the reception plane and not from the floor.)

|                    |                        |                          | LBB 4511/00 at full power   |                 |                |                 | LBB 4512/00 at full power   |                 |                |                 |
|--------------------|------------------------|--------------------------|-----------------------------|-----------------|----------------|-----------------|-----------------------------|-----------------|----------------|-----------------|
| number of carriers | mounting height [feet] | mounting angle [degrees] | area A [feet <sup>2</sup> ] | length L [feet] | width W [feet] | offset X [feet] | area A [feet <sup>2</sup> ] | length L [feet] | width W [feet] | offset X [feet] |
| 1                  | 8                      | 0                        | 6696                        | 108             | 62             | 23              | 13706                       | 154             | 89             | 33              |
|                    | 16                     | 15                       | 6732                        | 102             | 66             | 23              | 12835                       | 151             | 85             | 26              |
|                    |                        | 30                       | 5015                        | 85              | 59             | 13              | 8848                        | 112             | 79             | 20              |
|                    |                        | 45                       | 3068                        | 59              | 52             | 7               | 5214                        | 79              | 66             | 7               |
|                    |                        | 60                       | 2116                        | 46              | 46             | 0               | 3481                        | 59              | 59             | 0               |
|                    |                        | 90                       | 1521                        | 39              | 39             | -20             | 2116                        | 46              | 46             | -23             |
|                    |                        |                          |                             |                 |                |                 |                             |                 |                |                 |
|                    | 33                     | 15                       | 6324                        | 102             | 62             | 30              | 13892                       | 151             | 92             | 33              |
|                    |                        | 30                       | 5890                        | 95              | 62             | 16              | 10625                       | 125             | 85             | 20              |
|                    |                        | 45                       | 4425                        | 75              | 59             | 7               | 7268                        | 92              | 79             | 7               |
|                    |                        | 60                       | 3304                        | 59              | 56             | -3              | 5400                        | 75              | 72             | -3              |
|                    |                        | 90                       | 2704                        | 52              | 52             | -26             | 4356                        | 66              | 66             | -33             |
|                    |                        |                          |                             |                 |                |                 |                             |                 |                |                 |
|                    | 66                     | 30                       | 4424                        | 79              | 56             | 43              | 11659                       | 131             | 89             | 36              |
|                    |                        | 45                       | 3900                        | 75              | 52             | 23              | 10235                       | 115             | 89             | 13              |
|                    |                        | 60                       | 4464                        | 72              | 62             | 3               | 8075                        | 95              | 85             | -3              |
|                    |                        | 90                       | 3481                        | 59              | 59             | -30             | 7225                        | 85              | 85             | -43             |
| 2                  | 8                      | 15                       | 3312                        | 72              | 46             | 13              | 6195                        | 105             | 59             | 20              |
|                    | 16                     | 15                       | 3450                        | 75              | 46             | 16              | 6732                        | 102             | 66             | 23              |
|                    |                        | 30                       | 2666                        | 62              | 43             | 10              | 5015                        | 85              | 59             | 13              |
|                    |                        | 45                       | 1794                        | 46              | 39             | 3               | 3068                        | 59              | 52             | 7               |
|                    |                        | 60                       | 1404                        | 39              | 36             | -3              | 2116                        | 46              | 46             | 0               |
|                    |                        | 90                       | 1089                        | 33              | 33             | -16             | 1521                        | 39              | 39             | -20             |
|                    | 33                     | 30                       | 2852                        | 62              | 46             | 20              | 5890                        | 95              | 62             | 16              |
|                    |                        | 45                       | 2537                        | 59              | 43             | 7               | 4425                        | 75              | 59             | 7               |
|                    |                        | 60                       | 2107                        | 49              | 43             | -3              | 3304                        | 59              | 56             | -3              |
|                    |                        | 90                       | 1521                        | 39              | 39             | -20             | 2704                        | 52              | 52             | -26             |
|                    |                        |                          |                             |                 |                |                 |                             |                 |                |                 |
|                    | 66                     | 60                       | 2107                        | 49              | 43             | 10              | 4464                        | 72              | 62             | 3               |
|                    |                        | 90                       | 2116                        | 46              | 46             | -23             | 3481                        | 59              | 59             | -30             |
| 4                  | 8                      | 15                       | 1716                        | 52              | 33             | 10              | 3312                        | 72              | 46             | 13              |
|                    | 16                     | 15                       | 1560                        | 52              | 30             | 13              | 3450                        | 75              | 46             | 16              |
|                    |                        | 30                       | 1518                        | 46              | 33             | 10              | 2666                        | 62              | 43             | 10              |
|                    |                        | 45                       | 1080                        | 36              | 30             | 3               | 1794                        | 46              | 39             | 3               |
|                    |                        | 60                       | 990                         | 33              | 30             | -3              | 1404                        | 39              | 36             | -3              |
|                    |                        | 90                       | 676                         | 26              | 26             | -13             | 1089                        | 33              | 33             | -16             |
|                    | 33                     | 45                       | 1287                        | 39              | 33             | 10              | 2537                        | 59              | 43             | 7               |
|                    |                        | 60                       | 1170                        | 39              | 30             | 0               | 2107                        | 49              | 43             | -3              |
|                    |                        | 90                       | 1089                        | 33              | 33             | -16             | 1521                        | 39              | 39             | -20             |
|                    | 66                     | 90                       | 676                         | 26              | 26             | -13             | 2116                        | 46              | 46             | -23             |
|                    |                        |                          |                             |                 |                |                 |                             |                 |                |                 |
| 8                  | 8                      | 15                       | 897                         | 39              | 23             | 7               | 1716                        | 52              | 33             | 10              |
|                    | 16                     | 15                       | 660                         | 33              | 20             | 13              | 1560                        | 52              | 30             | 13              |
|                    |                        | 30                       | 759                         | 33              | 23             | 10              | 1518                        | 46              | 33             | 10              |
|                    |                        | 45                       | 690                         | 30              | 23             | 3               | 1080                        | 36              | 30             | 3               |
|                    |                        | 60                       | 529                         | 23              | 23             | 0               | 990                         | 33              | 30             | -3              |
|                    |                        | 90                       | 400                         | 20              | 20             | -10             | 676                         | 26              | 26             | -13             |
|                    | 33                     | 60                       | 529                         | 23              | 23             | 7               | 1170                        | 39              | 30             | 0               |
|                    |                        | 90                       | 529                         | 23              | 23             | -11             | 1089                        | 33              | 33             | -16             |

(The mounting height is the distance from the reception plane and not from the floor.)

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