

INTEGRUS



Security Systems

en | Installation and User Instructions
Integrus
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.

Table of contents

1	System description and planning	1
1.1	System overview	1
1.2	System technology	2
1.2.1	IR radiation	2
1.2.2	Signal Processing	2
1.2.3	Quality modes	2
1.2.4	Carriers and channels	3
1.3	Aspects of infra-red distribution systems	3
1.3.1	Directional sensitivity of the receiver	3
1.3.2	The footprint of the radiator	3
1.3.3	Ambient lighting	4
1.3.4	Objects, surfaces and reflections	5
1.3.5	Positioning the radiators	5
1.3.6	Overlapping footprints and multipath effects	6
1.4	Planning an Integrus infra-red radiation system	7
1.4.1	Rectangular footprints	7
1.4.2	Planning radiators	8
1.4.3	Cabling	8
1.5	Setting the radiator delay switches	9
1.5.1	System with one transmitter	9
1.5.1.1	Determining delay switch positions by measuring the cable lengths	9
1.5.1.2	Determining delay switch positions by using a delay measuring tool	10
1.5.2	System with two or more transmitters in one room	11
1.5.3	System with more than 4 carriers and a radiator under a balcony	13
1.6	Testing the coverage area	13
2	Integrus Transmitters	15
2.1	Description	15
2.2	Audio interface modules	16
2.2.1	Integrus DCN interface module	16
2.2.2	Mounting an interface module in the transmitter housing	17
2.2.3	Upgrading an LBB4502/xx to an INT-TX	18
2.2.3.1	Removing the main PCB and the rear panel	18
2.2.3.2	Installation of the INT-TXK	19
2.3	Connections	21
2.3.1	Connecting the DCN Next Generation	21
2.3.2	Connecting the DCN system	21
2.3.3	Connecting other external audio sources	21
2.3.4	Connecting an emergency signal	22
2.3.5	Connecting to another transmitter	22
2.4	Using the configuration menu	23
2.4.1	Overview	23
2.4.2	Navigate through the menu	24
2.4.3	Examples	25

2.5	Configuration and operation	30
2.5.1	Start-up	30
2.5.2	Main menu	30
2.5.3	View transmitter status	30
2.5.4	View fault status	31
2.5.5	Set monitoring options	32
2.5.6	View version information	33
2.5.7	Set transmission mode	33
2.5.8	Set network mode	33
2.5.9	Set number of channels	34
2.5.10	Set channel quality and assign inputs to channels	35
2.5.11	Set channel names	37
2.5.12	Disable or enable carriers	38
2.5.13	View carrier assignments	38
2.5.14	Configure auxiliary inputs	39
2.5.15	Set sensitivity of the inputs	40
2.5.16	Enable / disable IR-monitoring	40
2.5.17	Enable / disable headphone output	40
2.5.18	Choose transmitter name	41
2.5.19	Reset all options to factory default values	41
3	Integrus Radiators	42
3.1	Medium and High Power Radiators	42
3.1.1	Description	42
3.1.2	Radiator status indication	43
3.1.3	Mounting the radiators	44
3.1.4	Connecting radiators to the transmitter	45
3.1.5	Using the output power selection switch	46
3.2	Low Power Wide Beam Radiator	46
3.2.1	Description	46
3.2.2	Radiator Status Indication	47
3.2.3	Mounting the Radiator	47
4	Integrus Receivers	48
4.1	Description	48
4.2	Operation	49
4.3	Reception test mode	49
4.4	Receiver headphones	49
5	Integrus Charging Units	50
5.1	Description	50
5.2	Wall mounting the charging cabinet	51
5.3	Charging procedure	51
6	Troubleshooting	52

7	Technical Data	54
7.1	System Specification	54
7.2	Transmitters and Modules	55
7.2.1	Infra Red Transmitters	55
7.2.2	Transmitter Kit Board range	55
7.2.3	Integrus DCN interface module	55
7.3	Radiators and Accessories	55
7.3.1	Medium and High Power Radiators	55
7.3.2	Wall Mounting Bracket	56
7.3.3	Low Power Wide Beam Radiator	56
7.4	Receivers, Battery Packs and Charging Units	56
7.4.1	Pocket Receivers	56
7.4.2	Battery Pack	56
7.4.3	Charging Units	56
7.5	Connection details	57
7.5.1	Mains cables	57
7.5.2	Audio cables	57
7.5.3	Earphones	57
7.5.4	Emergency switch	57
7.6	Guaranteed rectangular footprints	58
	Product index	60

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).

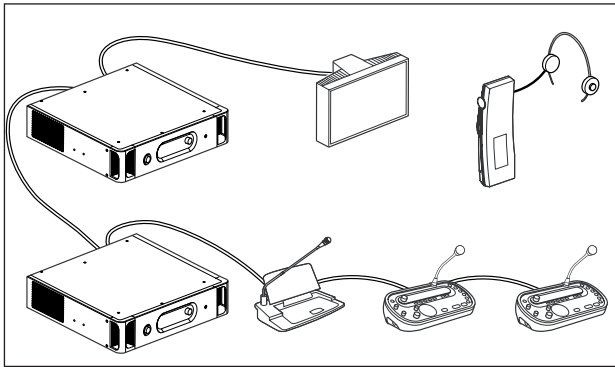


Figure 1.1 Integrus system overview
(with DCN-system as input)

The Integrus 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:

- INT-TX04 with inputs for 4 audio channels
- INT-TX08 with inputs for 8 audio channels
- INT-TX16 with inputs for 16 audio channels
- INT-TX32 with inputs for 32 audio channels

The transmitter can be directly connected to the DCN Next Generation conference system (see section 2.3).

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 3423/20 Integrus DCN interface module to connect to the Digital Congress Network (DCN).
- LBB 3222/04 Integrus audio input and interpreters module to connect to analogue discussion and conference systems (such as CCS 800) or to LBB 3422/20 6-channel interpreters desks.

Infra-red radiators

Three types of radiators are available:

- LBB 3410/05 low power wide beam radiator for small conference venues
- LBB 4511/00 medium-power radiator for small/medium conference venues
- LBB 4512/00 high-power radiator for medium/large conference venues

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

Infra-red receivers

Three multi-channel infra-red receivers are available:

- LBB 4540/04 for 4 audio channels
- LBB 4550/08 for 8 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. Two versions are available:

- LBB 4560/00 charging suitcase for portable systems
- LBB 4560/50 charging cabinet for permanent systems

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.

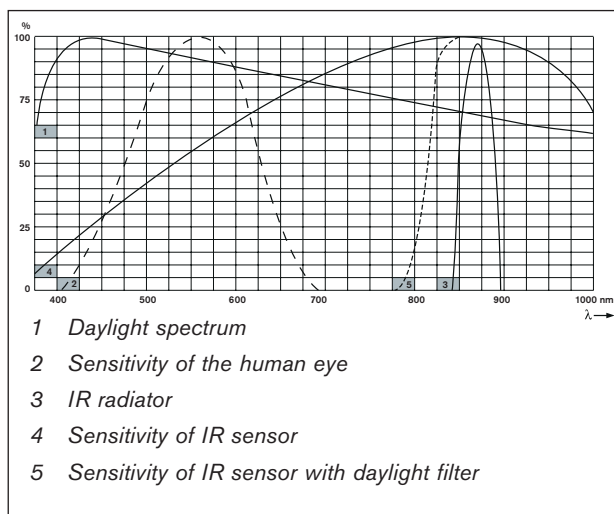


Figure 1.2 Infra-red radiation spectrum in relation to other spectra

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.

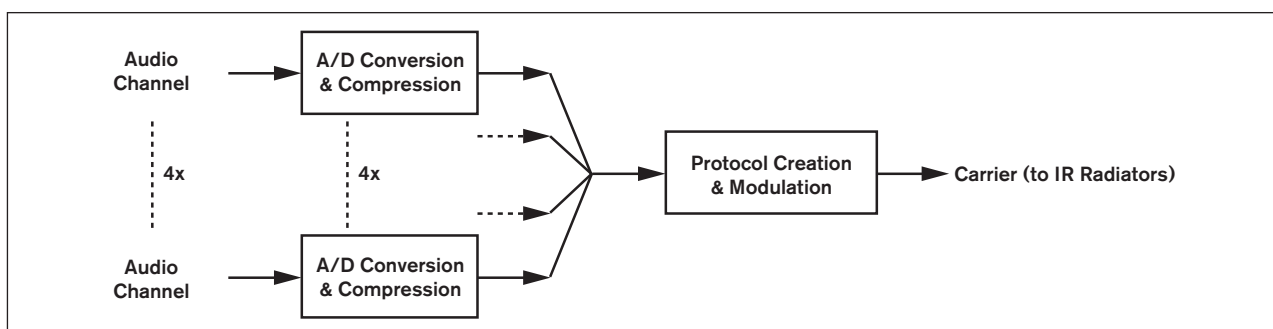


Figure 1.3 Overview of the signal processing (for one carrier)

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:

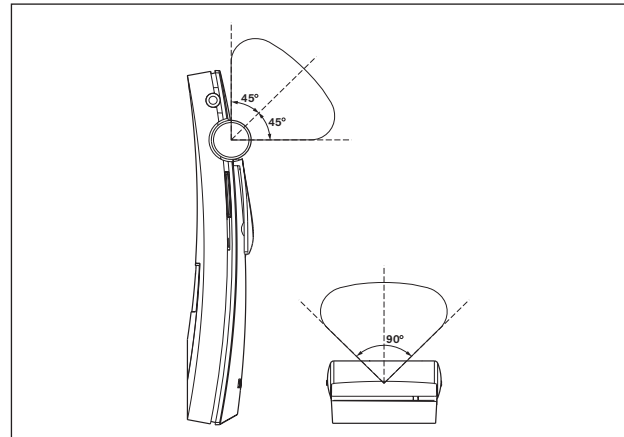


Figure 1.4 Directional characteristics of the receivers

	Channel quality				Bandwidth
	Mono Standard	Mono Premium	Stereo Standard	Stereo Premium	
Possible number of channels per carrier	4				4 x 10 kHz
	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)

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 4512/00 radiator is twice as large as the coverage area of the LBB 4511/00. 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/m² 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.

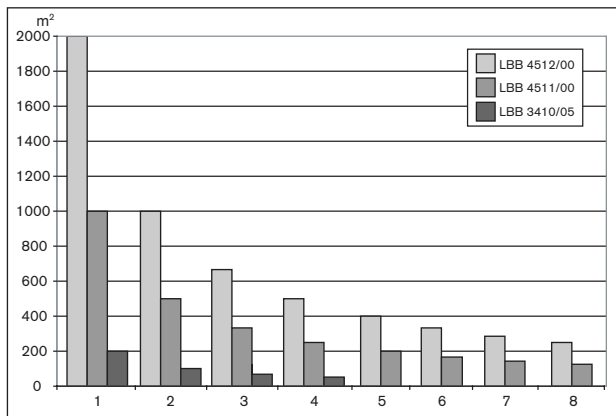


Figure 1.5 Total coverage area of LBB 3410/05, LBB 4511/00 and LBB 4512/00 for 1 to 8 carriers

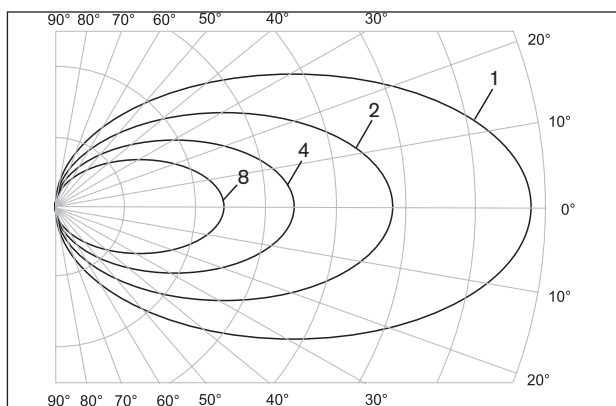


Figure 1.6 Polar diagram of the radiation pattern for 1, 2, 4 and 8 carriers

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.

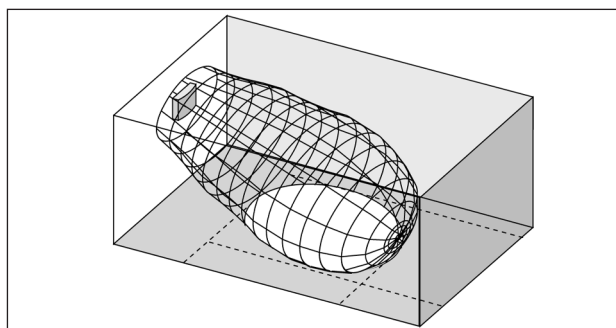


Figure 1.7 The radiator mounted at 15° to the ceiling

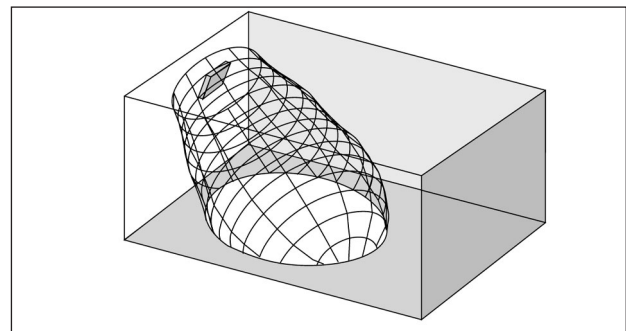


Figure 1.8 The radiator mounted at 45° to the ceiling

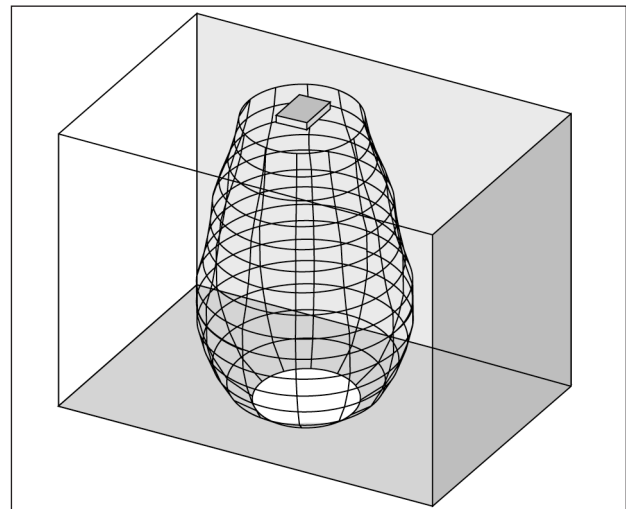


Figure 1.9 The radiator mounted perpendicular (at 90°) to the ceiling

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.

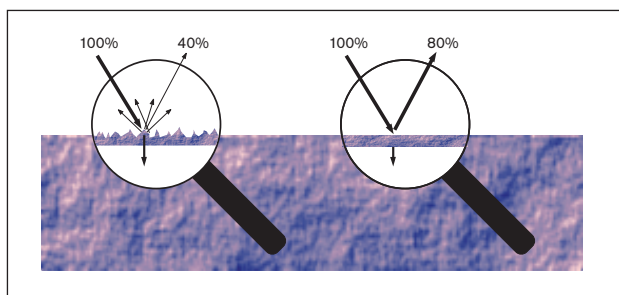


Figure 1.10 The texture of the material determines how much light is reflected and how much is absorbed

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).

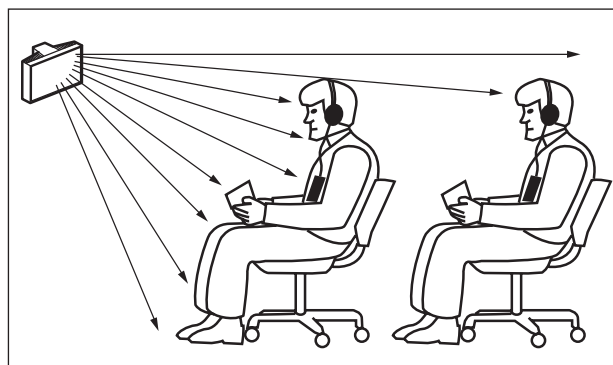


Figure 1.11 Infra-red signal blocked by a person in front of the participant

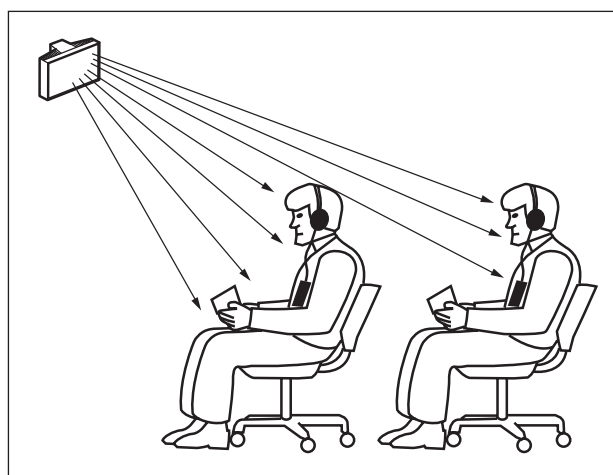


Figure 1.12 Infra-red signal not blocked by a person in front of the participant

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

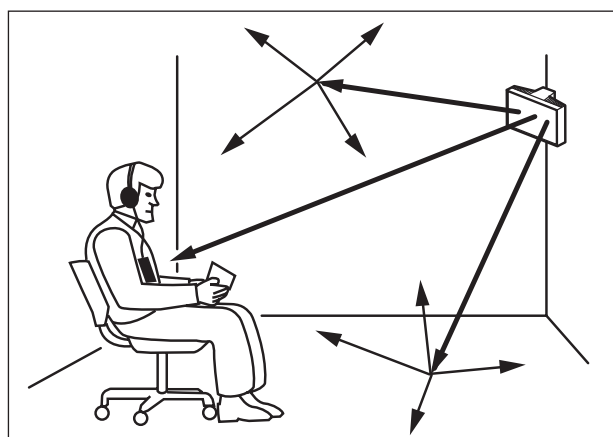


Figure 1.13 Combination of direct and reflected radiation

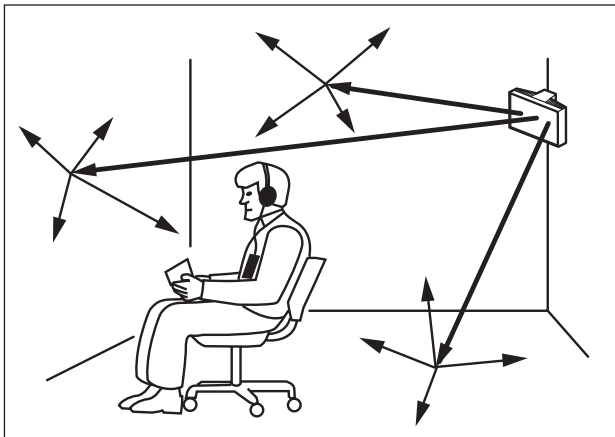


Figure 1.14 Combination of several reflected signals

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:

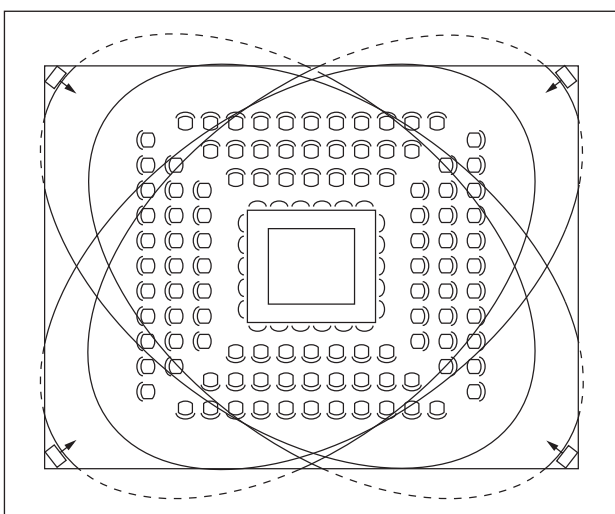


Figure 1.15 Radiator position for covering seats in a square arrangement

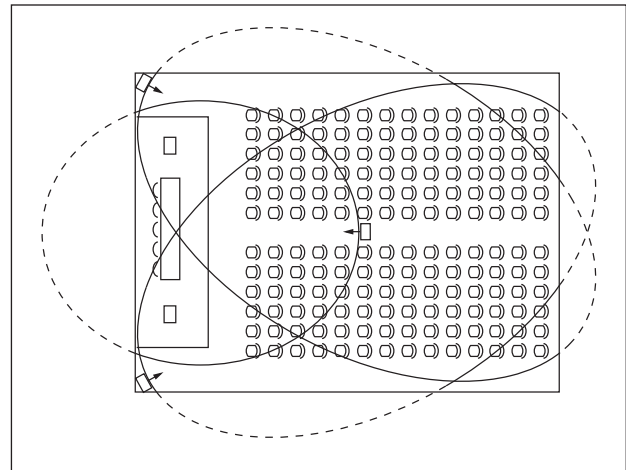


Figure 1.16 Radiator positioning in a conference hall with auditorium seating and podium

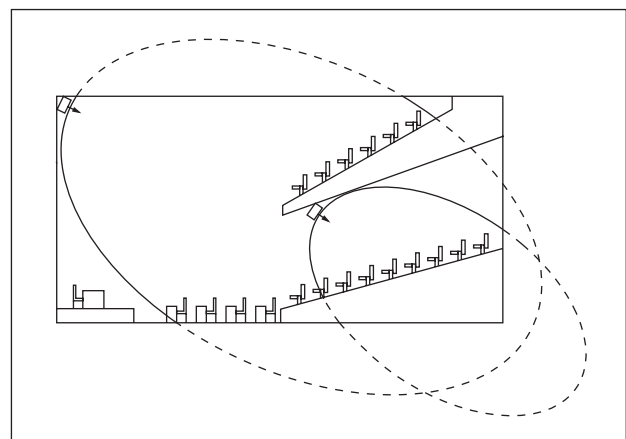


Figure 1.17 Radiator for covering seats beneath a balcony

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.

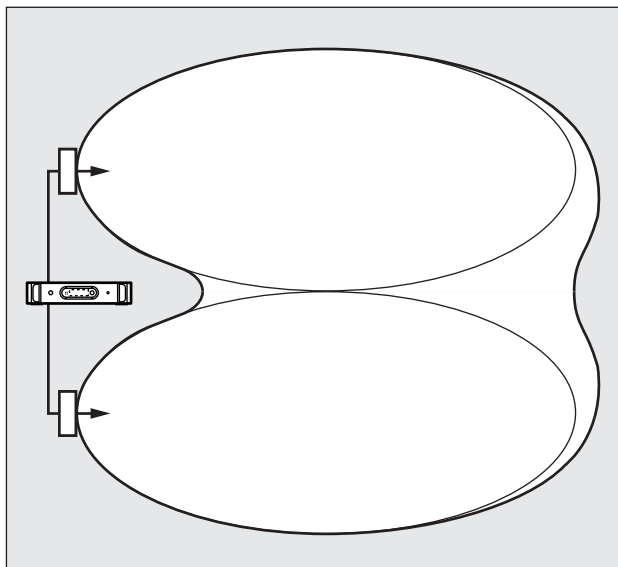


Figure 1.18 Increased coverage area caused by added radiation power

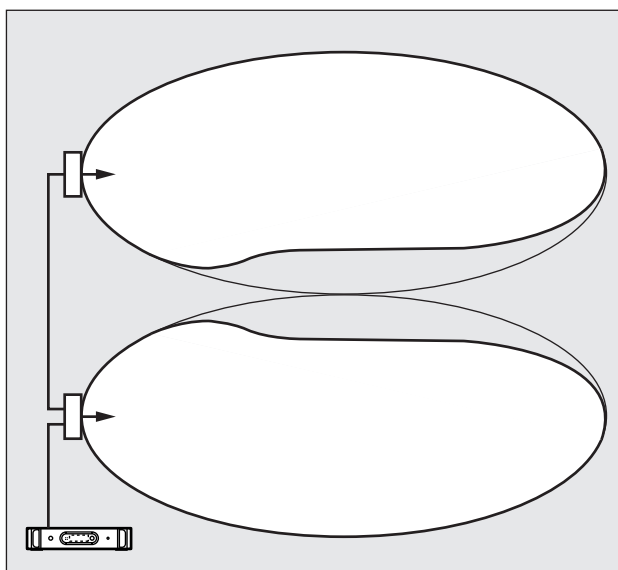


Figure 1.19 Reduced coverage area caused by differences in cable signal delay

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.

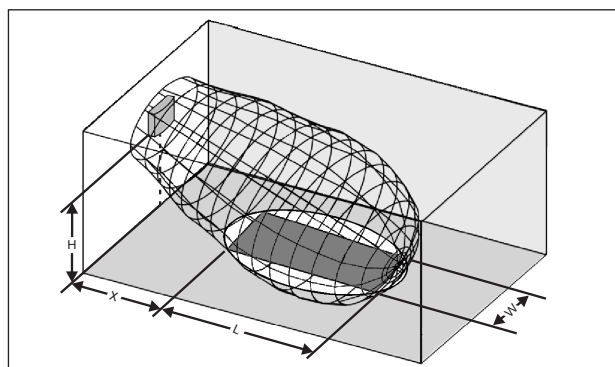


Figure 1.20 A typical rectangular footprint for a mounting angle of 15°

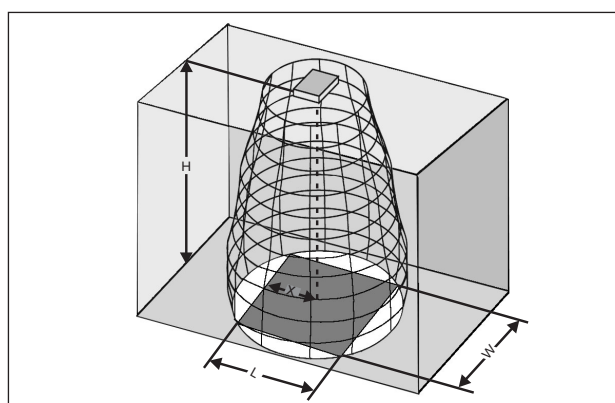


Figure 1.21 A typical rectangular footprint for a mounting angle of 90°

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).

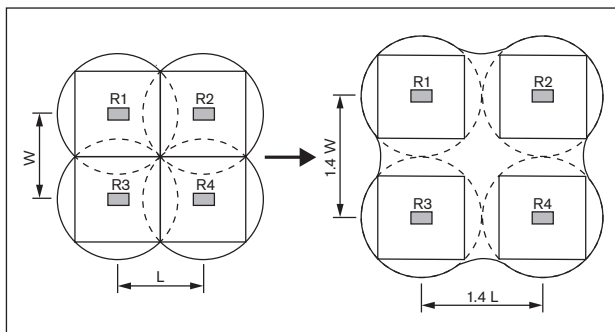


Figure 1.22 The effect of overlapping footprints

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).

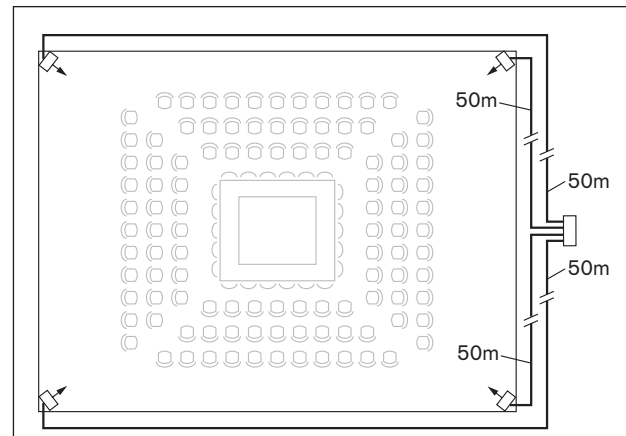


Figure 1.23 Radiators with equal cable length

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.

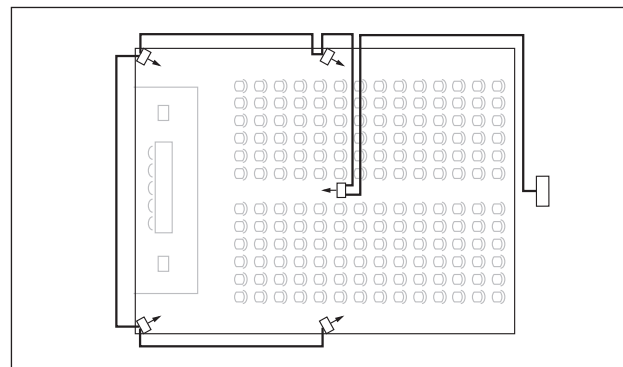


Figure 1.24 Asymmetrical arrangement of radiator cabling (to be avoided)

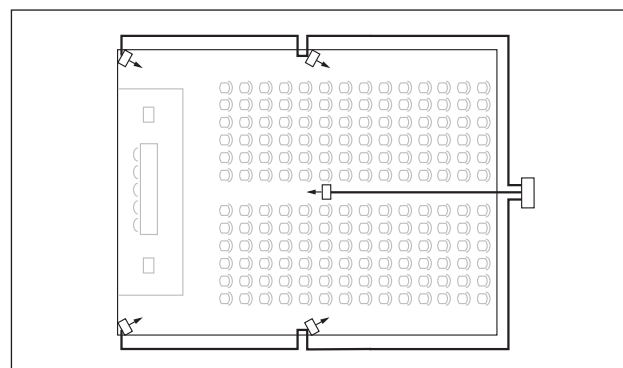


Figure 1.25 Symmetrical arrangement of radiator cabling (recommended)

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).

It is not necessary to calculate the cable signal delay in case:

- the radiators are directly connected to the transmitter with equal cable length;
- radiators are loop-through connected, but with less than 5 m distance between the first and last radiator in a trunk, and with equal cable length between the first radiator in each trunk and the transmitter.

In these cases 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.

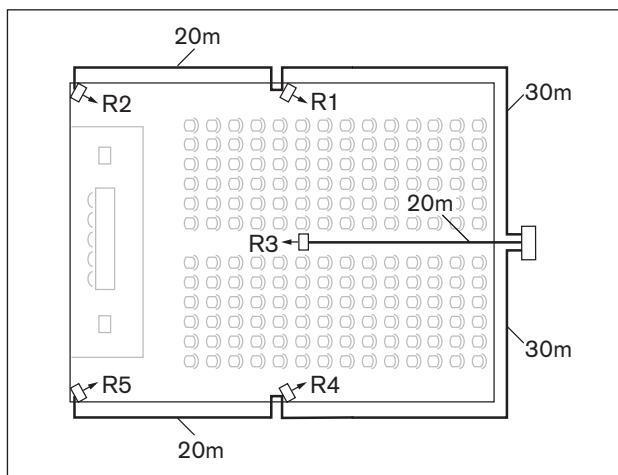


Figure 1.26 System with five radiators and measured cable lengths

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.



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.

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.

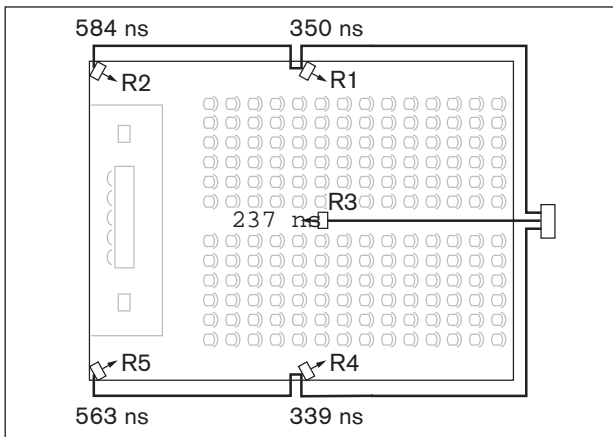


Figure 1.27 System with five radiators and measured impulse response times

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.

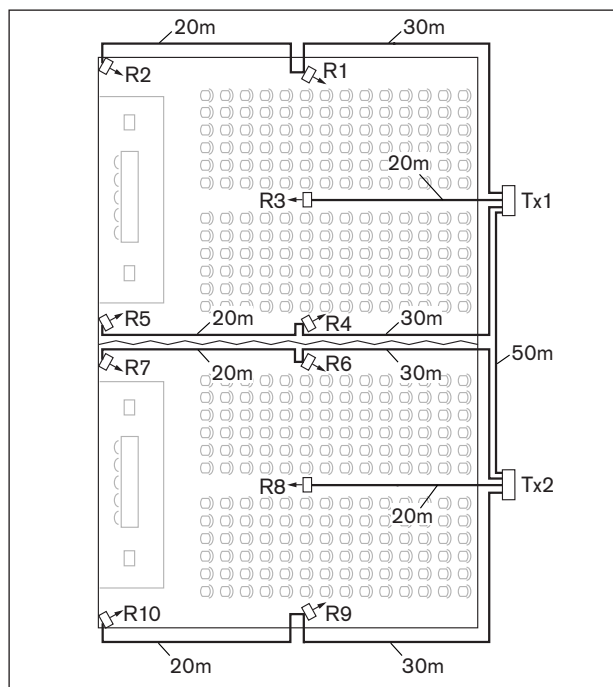


Figure 1.28, table 1.1, table 1.3 and table 1.4 illustrate the calculation of the extra master-slave signal delay.

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 [ns]
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.

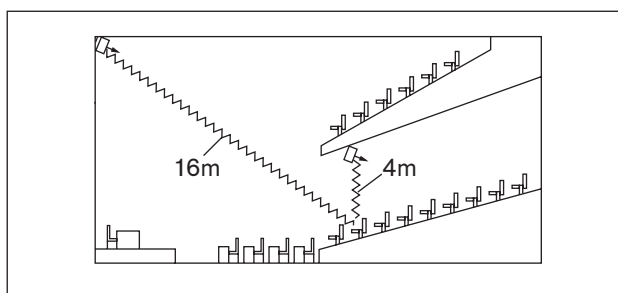


Figure 1.29 Radiation path length difference for two radiators

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, three 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.

Black spots can occur in case a transmitter is located in the same room as the radiators. In that case, disable the mini IR radiator of the transmitter with the configuration menu (see section 2.5.16).

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.

Interference from IR systems

IR assistive hearing systems and IR microphones operating at frequencies above 2 MHz, can disturb the reception at the lowest carriers. If such is the case, disable the lowest two carriers (see section 2.5.12) and re-check the reception.

2 Integrus Transmitters

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) and DCN Next Generation conference systems. It can also be used with analogue discussion and interpretation systems (e.g. CCS 800 with up to 12 interpreter 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.

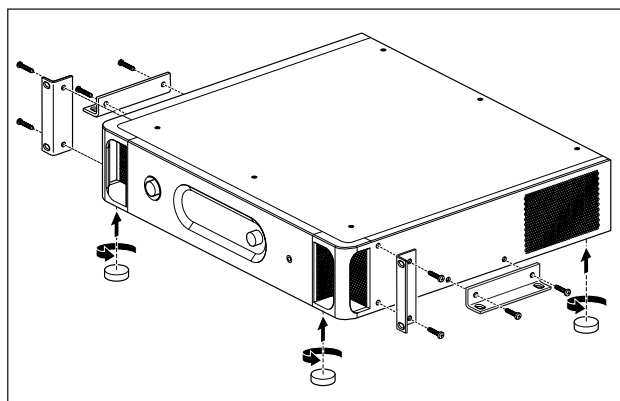


Figure 2.1 Transmitter with optional mounting brackets and table-top feet

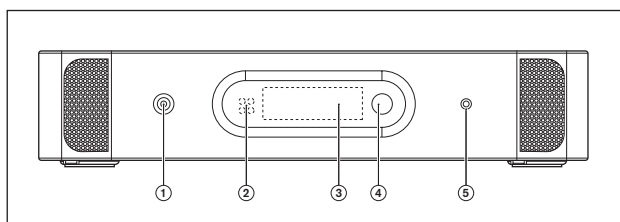


Figure 2.2 Transmitter, front view

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.

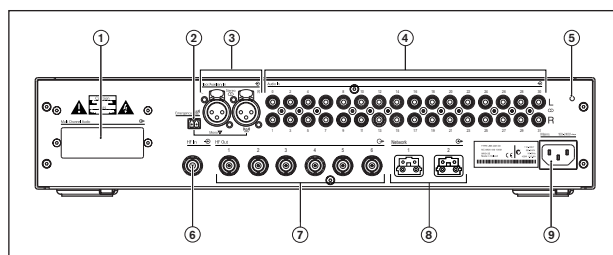


Figure 2.3 Transmitter, rear view

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. The emergency contact does not function when the network mode of the transmitter is enabled (see section 2.5.8) and it cannot connect to the optical network (e.g. because the control unit of the DCN Next Generation conference system is switched off).

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** – Six HF BNC connectors, used to connect the radiators. Up to 30 radiators can be loop-through connected to each output.
8. **Optical network connections** – Two connections used to connect directly to the DCN Next Generation conference system with an optical network cable.
9. **Mains input** – Euro mains socket. The transmitter has automatic mains voltage selection. A mains cable is provided.

2.2 Audio interface modules

2.2.1 Integrus DCN interface module

An Integrus 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).

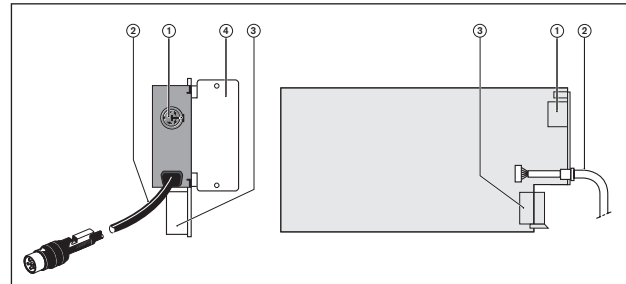


Figure 2.4 Integrus DCN interface module

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**
4. **Mounting plate**

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



Note: When the Integrus DCN interface module 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!



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 and figure 2.6.

1. Remove the top cover of the transmitter housing.
2. Remove the interface module slot cover (1) at the back of the transmitter. Keep the screws (2).
3. Insert the module (3) (with the components faced down) into the transmitter housing and push it firmly into the PCB connector (4).
4. Fasten the slot cover (5) to the back of the transmitter housing. Use the screws (2) from step 2.
5. Fasten the module's PCB to the distance studs (6). Use the screws (7) provided with the interface module.
6. Close the transmitter housing.



Warning: To prevent damage to the PCB connectors (4), be sure that the connectors are aligned properly before pushing the module in.

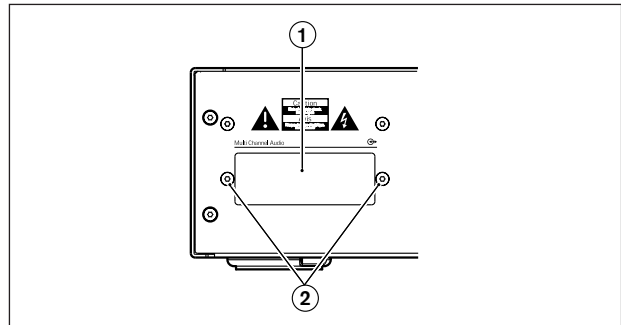


Figure 2.5 Interface module slot cover

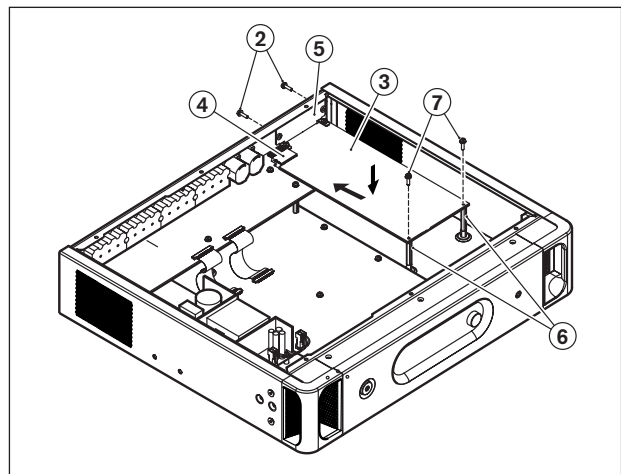


Figure 2.6 Mounting an interface module in the transmitter housing

2.2.3 Upgrading an LBB4502/xx to an INT-TX

To upgrade an LBB4502/xx to an INT-TX the following upgrade kits are available:

- INT-TXK04: 4 channel transmitter upgrade kit
- INT-TXK08: 8 channel transmitter upgrade kit
- INT-TXK16: 16 channel transmitter upgrade kit
- INT-TXK32: 32 channel transmitter upgrade kit

Each kit comprises the following items:

- 1 (type dependent) rear panel
- 1 (type dependent) main PCB
- 1 extra screw for the main PCB
- 1 glue stud



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



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

2.2.3.1 Removing the main PCB and the rear panel

Follow the instructions below to remove the main PCB and the rear panel. The numbers refer to figure 2.7 and figure 2.8.



Note: The upgrade kits do not contain new fixing materials. Therefore make sure to keep all screws and washers.

1. Remove the top cover of the transmitter housing.
2. If the transmitter contains an interface module (1): Remove the interface module proceeding in reverse order of mounting. The mounting instructions can be found in section 2.2.2. Note that the distance studs of the transmitter module can remain in place.
3. If the transmitter does not contain an interface module: Remove the interface module slot cover proceeding as described in section 2.2.2.
4. Remove the analogue input/output PCB (2):
 - Loosen the screws (3) between the cinch plugs on the rear panel (4). The number of screws depends on the transmitter type.
 - Loosen the screws (5) at the XLR connectors on the rear panel.
 - Loosen the screws (6) of the distance studs (7) of the analogue input/output PCB. Do not lose the (spring) washers (8).
 - On the main PCB (9) detach the flexible cables (10) to the analogue input/output PCB. To this end release the catches (11) on both sides and pull out the flexible cable. See inset in figure 2.7.
 - Remove the analogue input/output PCB.
5. Remove three distance studs (7A, 7B and 7C) of the analogue input/output PCB.
6. On the main PCB (9):
 - Detach the user interface cable (12).
 - Detach the power supply connector (13).
 - Loosen the screws (14) of the distance studs. Do not lose the (spring) washers (15).
7. Remove the main PCB.

8. Remove the rear panel (4):
 - Loosen the screws (16). Do not lose the (spring) washers (17).
 - Pull the connectors (18) of the mains inlet wires and the earth wire out of the mains socket (19).
 - Detach the mains socket from the rear panel. The mains socket is snapped into the rear panel.

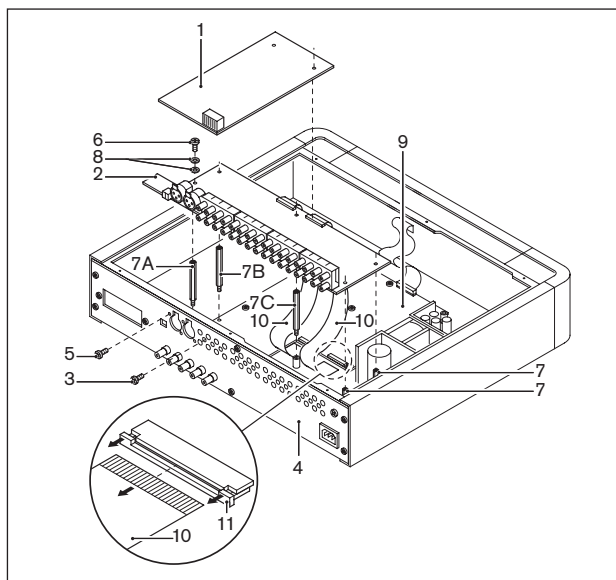


Figure 2.7 Removing the main PCB and the rear panel (steps 1 - 5)

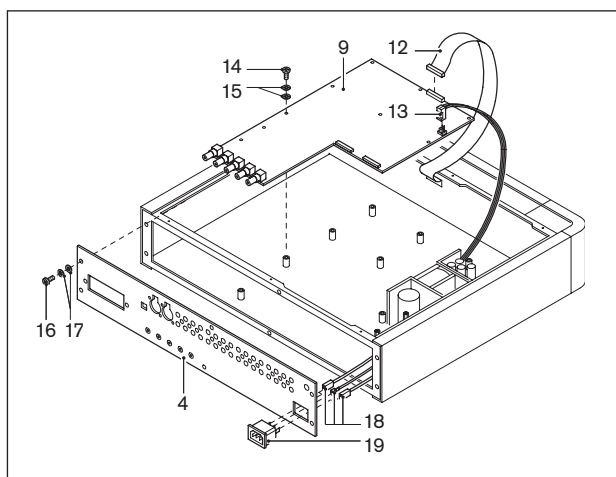


Figure 2.8 Removing the main PCB and the rear panel (steps 6 - 8)

2.2.3.2 Installation of the INT-TXK

Follow the instructions below to install the INT-TXK. The numbers refer to figures 2.9 and 2.10.

1. If the LBB4502/xx transmitter is missing a stud to mount the new main PCB (2) of the INT-TXK, paste the glue stud (1) from the upgrade kit to the bottom of the transmitter. See inset in figure 2.9 for the recommended pasting position.
2. Click the mains socket (3) in position in the new rear panel (4).
3. Fit the connectors (5) of the mains inlet wires (5A – brown, 5B – blue) and the earth wire (5C) on the pins of the mains socket.



Warning: Pay attention to the correct position of the mains inlet wires. See inset in figure 2.9.

4. Mount the rear panel using the screws (6) and the (spring) washers (7).
5. Install the main PCB (2) using the screws (8) and the (spring) washers (9). If the LBB4502/xx transmitter is provided with a stud to mount the main PCB, use the extra screw from the upgrade kit.
6. On the new main PCB:
 - Fasten the user interface cable (10).
 - Fasten the power supply connector (11).
7. Mount the three distance studs (12A, 12B and 12C) of the analogue input/output PCB through the orifices in the new main PCB.
8. Mount the analogue input/output PCB (13):
 - Place the analogue input/output PCB on its distance studs (12).
 - Fit the screws (14) with the (spring) washers (15).
 - Carefully give the screws a few turns. Do not yet tighten the screws.
 - Fit and tighten the screws (16) at the XLR connectors on the rear panel.
 - Fit and tighten the screws (17) between the cinch plugs on the rear panel.
 - Tighten the screws (14) of the distance studs (12).

9. On the new main PCB (2) fasten the flexible cables (18) to the analogue input/output PCB. To this end release the catches (19) on both sides and insert the flexible cable.



Note: Make sure that the flexible cables are entirely and correctly inserted into the connector as incorrect mounting will lead to transmitter failure.
See inset in figure 2.10.

10. If the transmitter contained an interface module (20): Mount the interface module proceeding as described in section 2.2.2.
11. If the transmitter did not contain an interface module: Mount the interface module slot cover on the new rear panel.
12. Mount the top cover of the transmitter housing.

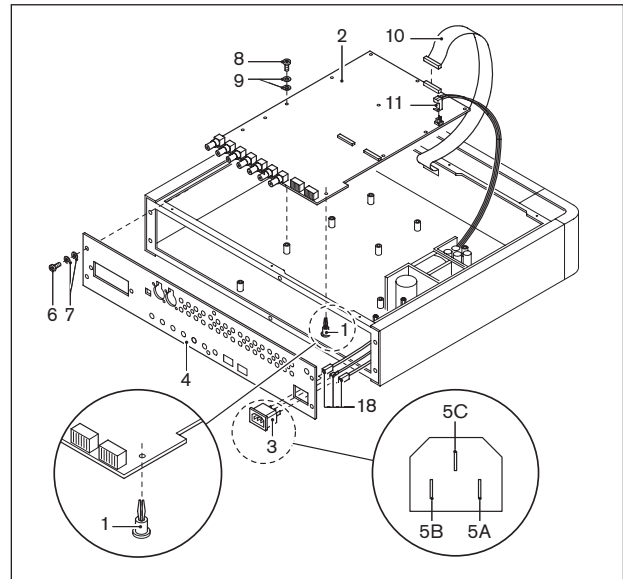


Figure 2.9 Installation of the INT-TXK (steps 1 - 6)

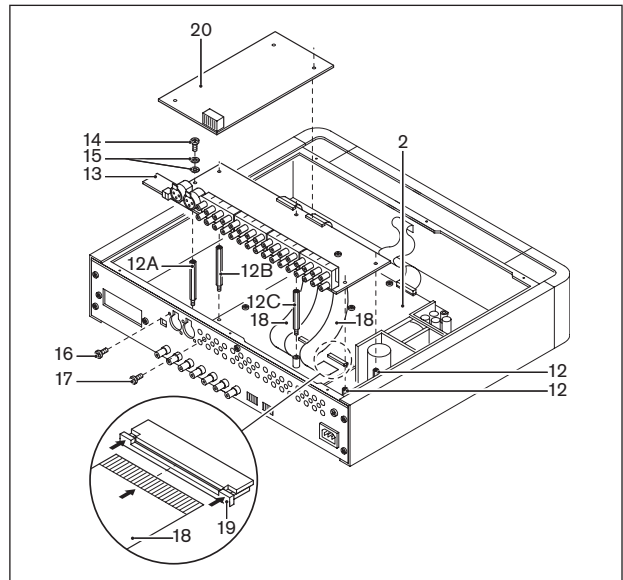


Figure 2.10 Installation of the INT-TXK (steps 7 - 12)

2.3 Connections

This chapter gives an overview of typical system connections using the INT-TX range transmitter:

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

2.3.1 Connecting the DCN Next Generation

The transmitter can be directly connected to the optical network of the DCN Next Generation conference system. Use an optical network cable to connect one of the optical network sockets of the transmitter to the optical network (see figure 2.11). The network mode must be enabled with the configuration menu (see section 2.5.8).



Note: See the DCN Next Generation Installation and User Instructions for more information about connecting the transmitter in the optical network.

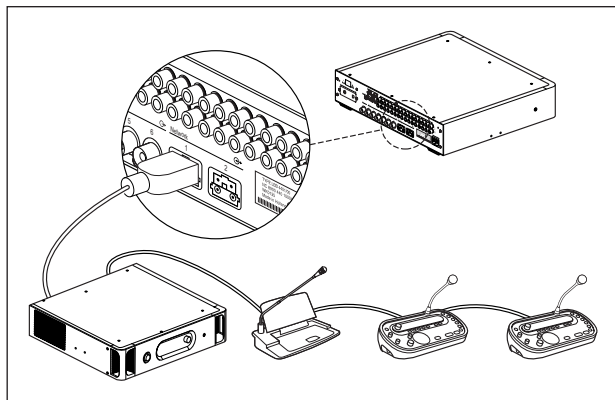


Figure 2.11 Connecting the optical network to the modular IR transmitter

2.3.2 Connecting the DCN system

The transmitter requires the Integrus DCN Interface Module (LBB 3423/20) 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.

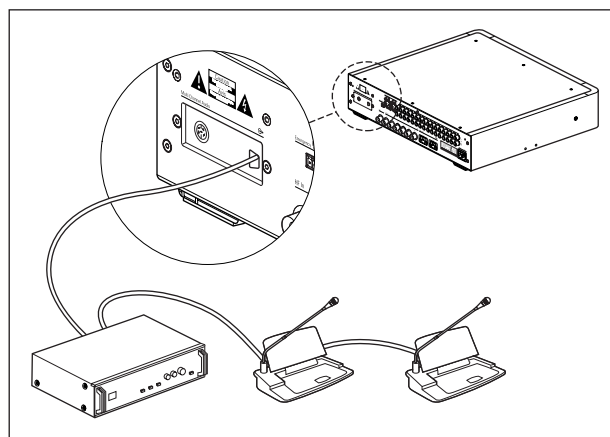


Figure 2.12 Connecting the DCN systems to the Modular IR transmitter

2.3.3 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.

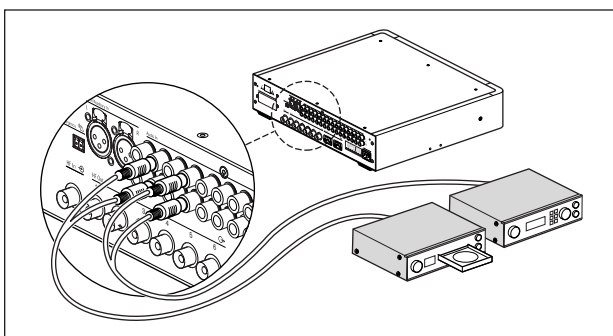


Figure 2.13 Connecting external audio sources to the Modular IR transmitter

2.3.4 Connecting an emergency signal

To use the emergency signal function, a switch (normally-open) must be connected to the emergency switch connector. The reaction of the transmitter on a closed switch depends on the configuration of the auxiliary inputs (see also section 2.5.14):

- If the auxiliary input is 'Mono + Emergency', the audio signal on the Aux-Right input is distributed to all output channels, overriding all other audio inputs.
- If the auxiliary input is 'Stereo' or 'Stereo to Mono', the audio signals on the Aux-Left and Aux-Right inputs are distributed to all output channels, overriding all other audio inputs.



Note: When the network mode is enabled (see section 2.5.8), the emergency signal function is not available when the control unit of the DCN Next Generation conference system is switched off or defective.

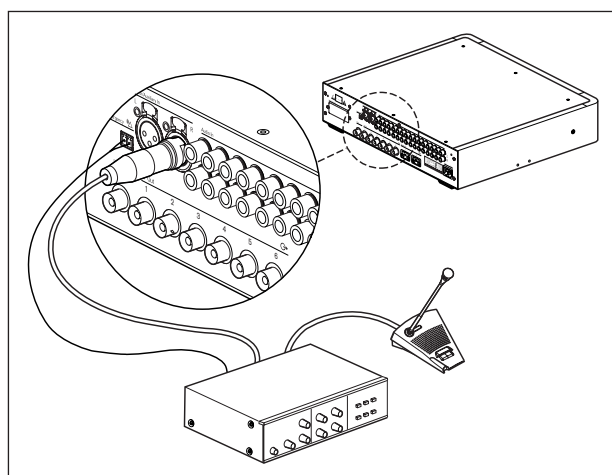


Figure 2.14 Connecting an emergency signal

2.3.5 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).

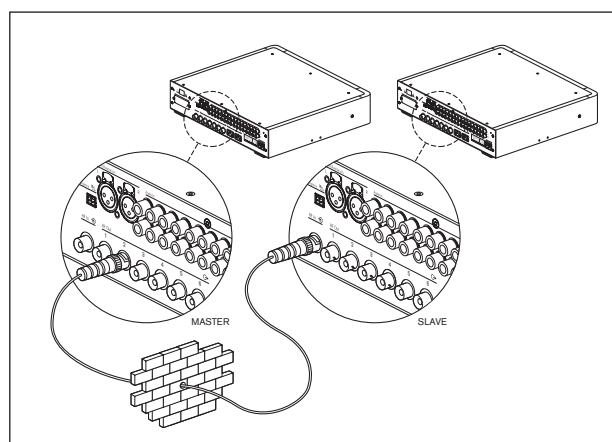


Figure 2.15 Connecting to another transmitter

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 2.16 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.

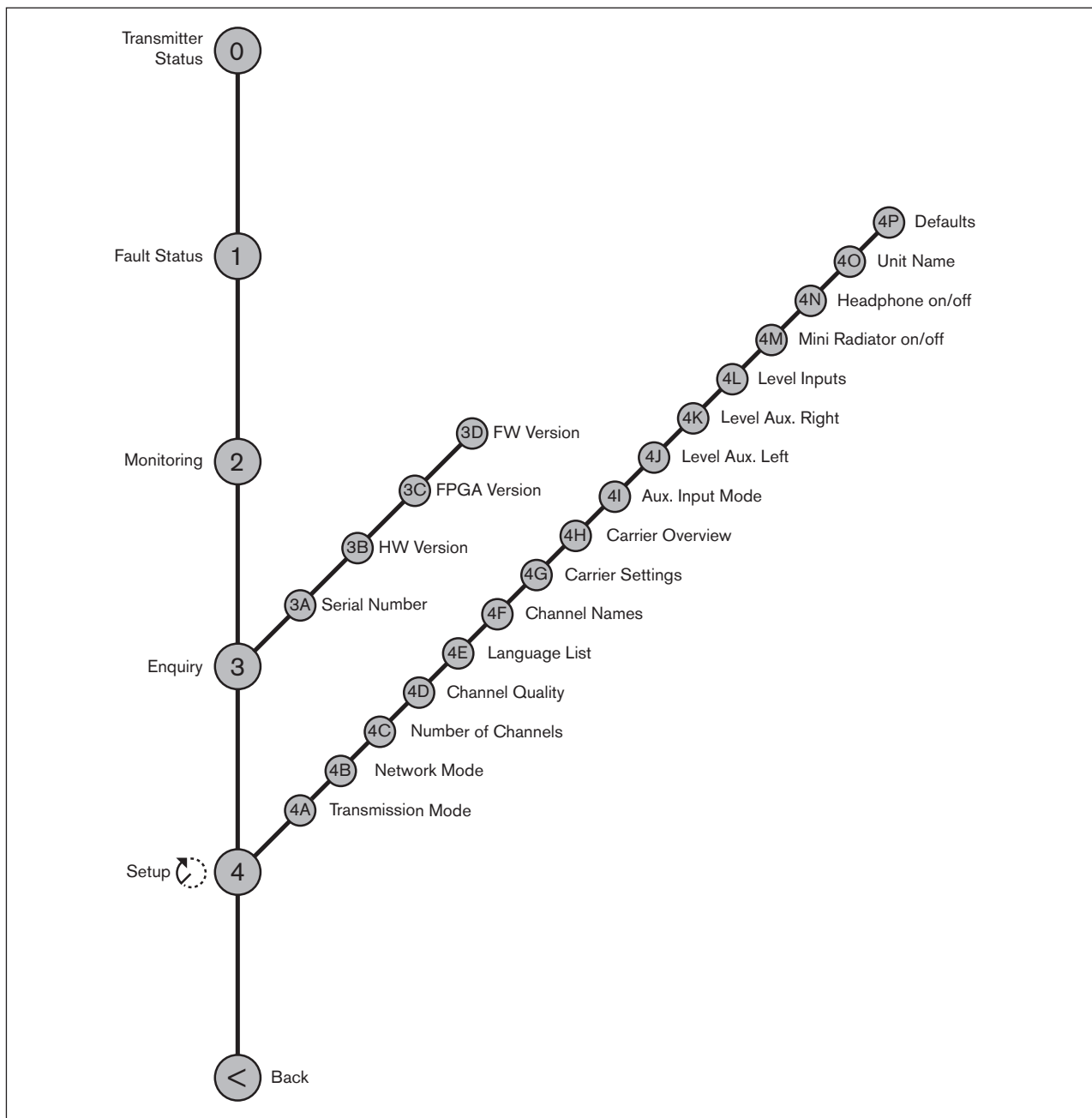


Figure 2.16 Menu overview

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 3 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.

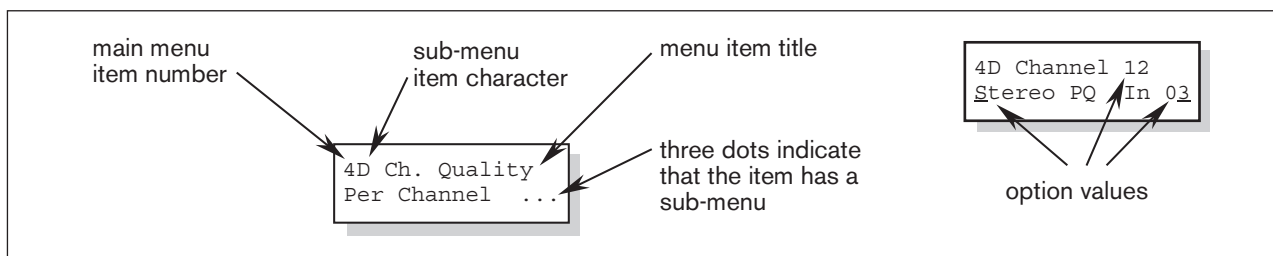
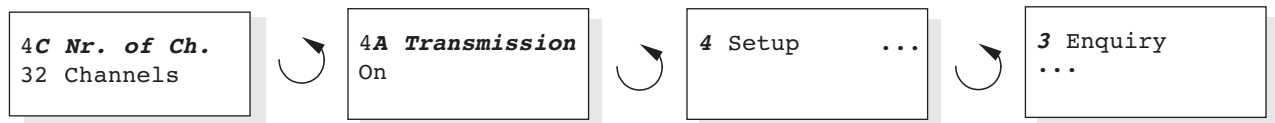


Figure 2.17 Menu item screen elements

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:

**To jump back from an item of the Main menu to the Transmitter Status:**

1. Turn the button to the < Back screen.
2. Push the button to go to the Transmitter Status.

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 2.5.11).

<p>Transmitter 32 Channels</p>	<p>1. Turn the button to select the 'Setup' item (4) in the Main menu.</p>	<p>4G Carrier 2 <u>E</u>nabled</p>	<p>8. Push to confirm.</p>
<p>4 Setup</p>	<p>2. Push and hold the button for 3 seconds to go to the 'Setup' sub-menu.</p>	<p>4G Carrier 2 Enabled</p>	<p>9. Turn to select 'Disabled'.</p>
<p>4A Transmission On</p>	<p>3. Turn to select the 'C.Settings' sub-menu item (4G).</p>	<p>4G Carrier 2 Disabled</p>	<p>10. Push to confirm.</p>
<p>4G C.Settings...</p>	<p>4. Push to go to the 'C.Settings' sub-menu.</p>	<p>4G Carrier 2 <u>D</u>isabled</p>	<p>11. Turn to move the cursor to the Main menu item number (4).</p>
<p>4G Carrier 0 Enabled</p>	<p>5. Turn to select carrier 2.</p>	<p><u>4</u>G Carrier 2 Disabled</p>	<p>12. Push to confirm.</p>
<p>4G Carrier 2 Enabled</p>	<p>6. Push to confirm.</p>	<p>4 Setup ...</p>	<p>13. Turn to select the < Back screen.</p>
<p>4G Carrier <u>2</u> Enabled</p>	<p>7. Turn to move the cursor to the second line.</p>	<p>< Back ...</p>	<p>14. Push to confirm</p>
		<p>Transmitter 32 Channels</p>	<p>15. Ready</p>

Example 2: Assign a new user defined name to channel 12. (See also section 2.5.11.)

Transmitter 32 Channels	1. Turn the button to select the 'Setup' item (4) in the Main menu.	4F Channel 12 · - - -	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.	4F Channel 12 · = - -	12. Push to confirm.
4A Transmission On	3. Turn to select the 'Ch. Names' sub-menu item (4F).	4F Channel 12 · - - -	13. Turn to select the first character (C).
4F Ch.Names ... Floor	4. Push to go to the 'Ch. Names' sub-menu.	4F Channel 12 · C--	14. Push to confirm this character.
4F Channel 00 Spanish	5. Turn to select the required channel number (12).	4F Channel 12 · C--	15. Repeat steps 11 to 14 for the other characters.
4F Channel 12 Spanish	6. Push to confirm.	4F Channel 12 · CD Music	16. Turn to move the cursor to the Main menu item number (4).
4F Channel 12 Spanish	7. Turn to move the cursor to the start of the second line.	4F Channel 12 · CD Music	17. Push to confirm.
4G Carrier 12 Spanish	8. Push to confirm.	4 Setup ...	18. Turn to select the < Back screen.
4F Channel 12 Spanish	9. Turn clockwise until the channel name changes to: · - - -	< Back ...	19. Push to confirm
4F Channel 12 · - - -	10. Push to confirm.	Transmitter 32 Channels	20. Ready

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 2.5.10.)

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

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

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

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

18. Push to confirm.

4D Channel 11
Stereo PQ In 14

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

4D Channel 11
Stereo PQ In 14

20. Push to confirm.

4 Setup ...

21. Turn to select the < Back screen.

< **Back** ...

22. Push to confirm

Transmitter
32 Channels

23. 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 asterisk (*) 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 3 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
Transmitter Status	Shows the transmitter status (see section 2.5.3)
1 Fault Status	Shows the radiator fault status (see section 2.5.4)
2 Monitoring . . .	Go to the ‘Monitoring’ sub-menu (see section 2.5.5)
3 Enquiry . . .	Go to the ‘Enquiry’ sub-menu (see section 2.5.6)
4 Setup . . .	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).*

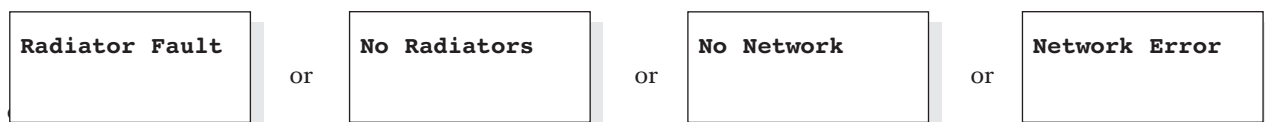
Menu Items	Options (read only)	Description
Transmitter Status	Name	The first line shows the user defined name of the transmitter (see section 2.5.16).
	Mode: - <u>nn</u> Channels - Aux to All - <u>nn</u> Ch. Test - Slave - Standby - Emergency Call	The second line shows the actual transmission mode: Audio signals are distributed on <u>nn</u> channels. The signal on the Aux. inputs is distributed on all channels. The test signals are distributed on <u>nn</u> channels. The transmitter operates in slave-mode: the radiator signal on the slave input is looped-through to all radiator outputs. The transmitter is in stand by mode. An emergency signal from the Aux. inputs is distributed to all channels.
	DCN	The text 'DCN' is shown at the right side of the second line when a DCN or a DCN Next Generation 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
1 Fault Status	Fault:	
	- No Faults	The connected radiators function without problems.
	- Radiator Fault	One of the connected radiators is not functioning properly.
	- No Radiators	No radiators are connected to the transmitter.
	- No Network	When the Network Mode (see section 2.5.8) is Enabled, this fault is shown when there is a fault in the optical network.
	- Network Error	When the Network Mode (see section 2.5.8) is Disabled, this fault is shown when there is a fault in the optical network. This message usually occurs when the Network Mode (see section 2.5.8) is disabled, and a DCN Next Generation CCU is 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 (4J, 4K or 4L), or when assigning inputs to channels (menu 4D, 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 2.5.18), 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	Source:			
	- In. <u>nn</u>	Input nr: 00 ... 31	Volume: -31 ... 0 dB	The signal from audio input <u>nn</u> is available on the monitoring headphone output.
	- Ch. <u>nn</u>	Channel nr: 00 ...31	Volume: -31 ... 0 dB	The signal on channel <u>nn</u> is available on the monitoring headphone output.
	- Aux.L		Volume: -31 ... 0 dB	The signal on the Aux. Left input is available on the monitoring headphone output.
	- Aux.R		Volume: -31 ... 0 dB	The signal on the Aux. Right input is available on the monitoring headphone output.
	- None		Volume: -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 Serial Number	e.g. 19.0.00001	Shows the serial number of the transmitter board.
3B HW Version	e.g. 01.00	Shows the version number of the transmitter board.
3C FPGA Version	e.g. 2.00.00	Shows the version number of the FPGA software of the transmitter board.
3D FW Version	e.g. 1.00.0001	Shows the version number of the transmitter firmware.

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 an Integrus system with a DCN Next Generation system (see section 2.5.8), the transmitter is automatically switched to 'Standby' when the connected DCN Next Generation system is switched off.

When the DCN Next Generation system is switched on, the transmitter is automatically switched to 'On'. When using an Integrus 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	<u>Mode:</u>	
	- 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 (4D).
	- Aux to All	The signals on the Auxiliary inputs are distributed on one carrier to all 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 network mode

The network mode menu item (4B) is used to enable and disable the optical network connections. When the transmitter is connected to a DCN Next Generation conference system, the optical network connections must be enabled.

Menu Items	Option	Description
4B Network Mode	<u>Mode:</u>	
	- Disabled	Optical network connections disabled. Use this mode when the transmitter is not used in combination with DCN Next Generation.
	- Enabled	Optical network connections enabled. Use this mode when the transmitter is used in combination with DCN Next Generation.

2.5.9 Set number of channels

Via sub-menu item 4C 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 Next Generation or a DCN system is connected to the transmitter, the number of channels can be automatically set by the connected system.

Menu Items	Option	Description
4C Nr. of Ch.	Nr. of channels	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 Next Generation or a DCN system is connected to the transmitter, the number of channels is determined by the settings of the connected system.
	* - Automatic: <u>nn</u>	
	- Manual: <u>nn</u>	Set the number of used channels (the maximum number depends on the transmitter type and the selected quality modes). An asterisk (*) is shown when the selected number is not possible because it is higher than the maximum number of channels.

2.5.10 Set channel quality and assign inputs to channels

The audio quality of the channels (mono/stereo, standard/premium) can be set in sub-menu 4D. 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 4D (Per Channel Settings), the assignment can also be done for each channel separately.

Menu Items	Option	Description
4D Ch. Quality	Quality:	
	* 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.

If, in the network mode, stereo quality is selected, the floor language is assigned to the left channel and the translation is assigned to the right channel. This can be used for language learning applications.

Per Channel Settings:

Menu Item	Options	Description
4D Channel <u>nn</u>	Channel nr.: 00 ... 31	Select which channel to configure.
	Quality: - Disabled * - Mono SQ - Mono PQ - Stereo SQ - Stereo PQ	Disable selected channel. Set selected channel to mono, standard quality. Set selected channel to mono, premium quality. Set selected channel to stereo, standard quality. Set selected channel to stereo, premium quality.
	Source: In 00 .. 31	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.
	On 00 .. 31	Select the optical network channel that should be distributed on the selected channel.



Note: An asterisk (*) is shown behind the channel number when the channel in the configured quality does not fit on the available carriers (see section 1.2.4).

With an optical network connected, an asterisk (*) is shown behind the input number and the channel number when the selected input can not be routed to the selected channel, due to the routing limitations of the hardware. The user has to browse through the inputs in order to determine which input can be routed to the selected channel.

Without an optical network connected, an asterisk (*) is shown behind the input number and the channel number when an optical network channel (On) is selected, or when an input is selected that can not be routed to the selected channel due to the routing limitations of the hardware (typically inputs 28, 29, 30 & 31 can not be routed to other carriers than carrier 7).

2.5.11 Set channel names

Each channel can be assigned a name via the Channel Names menu (4F). 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 2.4.3. The language in which the pre-defined names are presented can be chosen via the Language List menu option (4E).

Menu Item	Options	Description
4F Ch. Names ...		Push the button to go to the sub-menu.
4F Channel <u>nn</u>	<p>Channel nr.: 00 ... 31</p> <p>Language name: * - 'Floor' - ISO language names - User defined names</p>	<p>Select which channel to name.</p> <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 Item	Options	Description
4E Language List	<p>Language: * English French Original</p>	<p>Present language list in English.</p> <p>Present language list in French.</p> <p>Present each language name in it's original language (e.g. English, Français, Deutsch, etc.)</p>

2.5.12 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 (4G).

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

2.5.13 View carrier assignments

With menu option 4H 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.

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

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

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

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

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

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

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

2.5.14 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 (4I).

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
4I Aux. Input	Type: * - Stereo	The Aux. inputs will be distributed in stereo to all 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 all channels when the emergency switch is closed.

2.5.15 Set sensitivity of the inputs

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

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

Per Input Sensitivity settings:

Menu Items	Options	Value	Description
4L Sens.Input <u>nn</u>	<u>Input nr.:</u> 00 ... 31	<u>Level:</u> -6... +6 dB	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.

2.5.16 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 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 (4O).

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

2.5.19 Reset all options to factory default values

Use menu item 4P 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 asterisk (*) in the menu descriptions.)

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

3 Integrus Radiators

3.1 Medium and High Power Radiators

3.1.1 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 16 Wpp, while the LBB 4512/00 has an infra-red output of 32 Wpp. 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 stand-by if the temperature of the IREDs becomes too high.

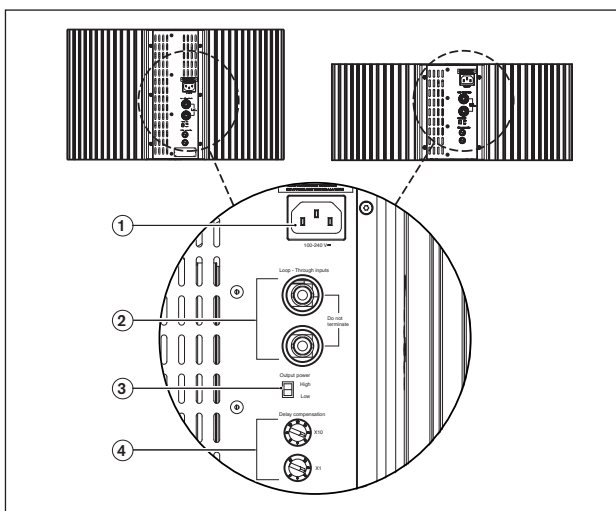


Figure 3.1 LBB 4511/00 and LBB4512/00 Radiators (Back view)

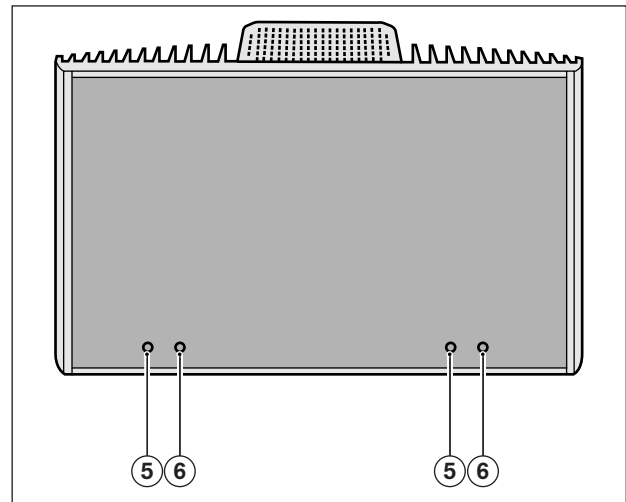


Figure 3.2 LBB 4512/00 High Power Radiator (Front view)

Figure 3.1 and 3.2

1. **Mains input** - Male Euro mains connector. The radiators have automatic mains voltage selection.
2. **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.
3. **Output power selection switch** - The radiators can be switched between full- and half-power operation.
4. **Delay compensation switches** - Two 10-position switches to compensate for differences in cable lengths to the radiators.
5. **Amber indicator LEDs** - Give an indication of the radiator status.
6. **Red indicator LEDs** - Give an indication of the radiator status.



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

3.1.2 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: Initialising signal equalisation During operation: Temperature protection mode. See chapter 6, Trouble-shooting
	on	on IRED panel failure. See chapter 6, Trouble-shooting


3.1.3 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.

 **Warning:** When you install the radiator in a ceiling, you must leave at least 1 m³ of free space around the back of the radiator. To prevent the radiator from becoming too hot, make sure that there is a good airflow in this free space.

 **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 airflow 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°.

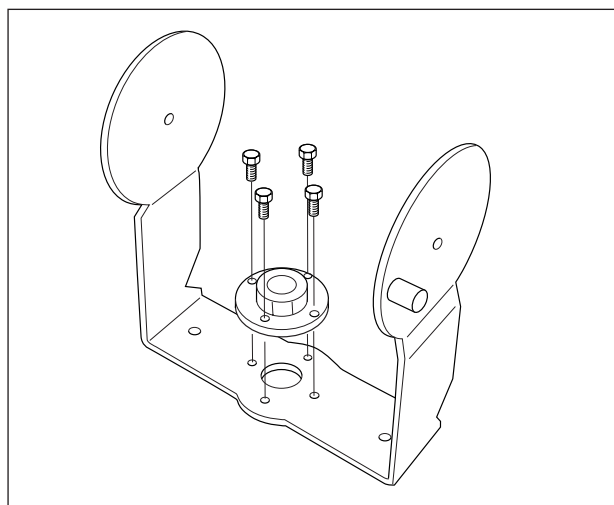


Figure 3.3 Attaching the plate to the suspension bracket

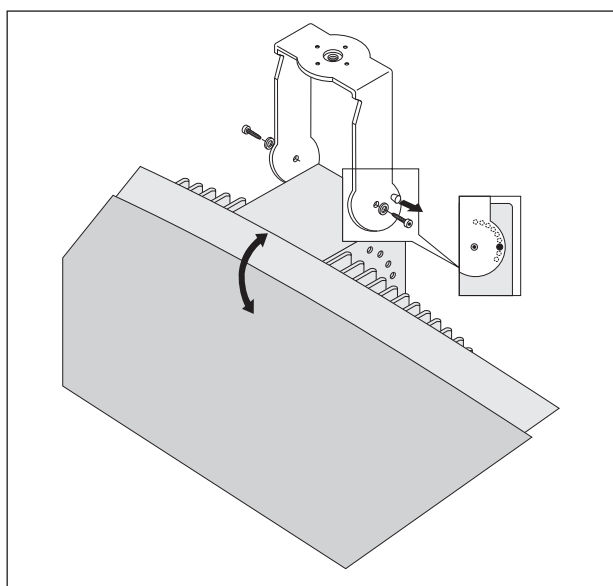


Figure 3.4 Attaching the suspension bracket to the radiator

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°.

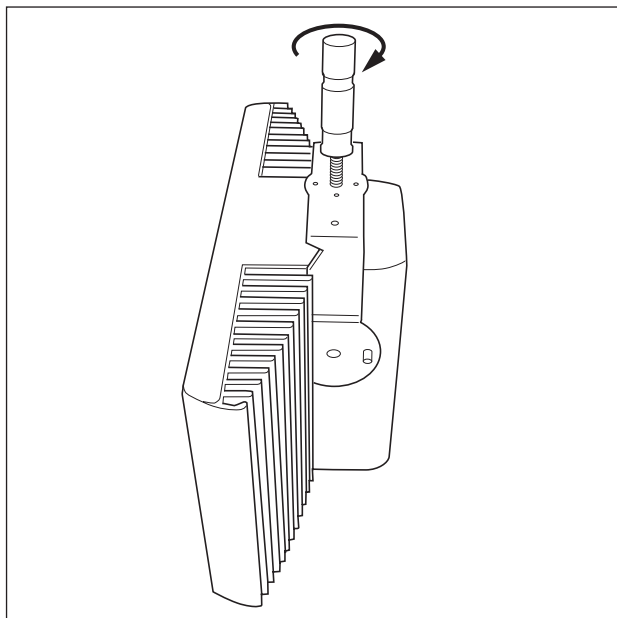


Figure 3.5 Attaching the stud of a floor stand to the suspension bracket of the radiator

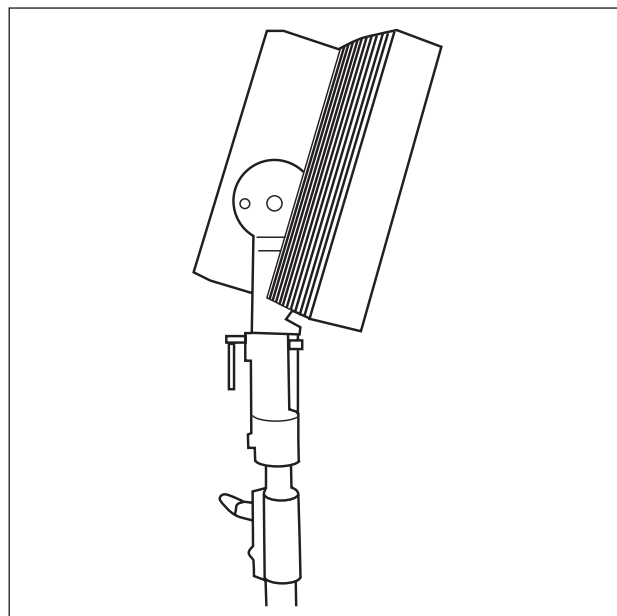


Figure 3.6 Attaching the radiator inclusive suspension bracket and stud to the floor stand

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.

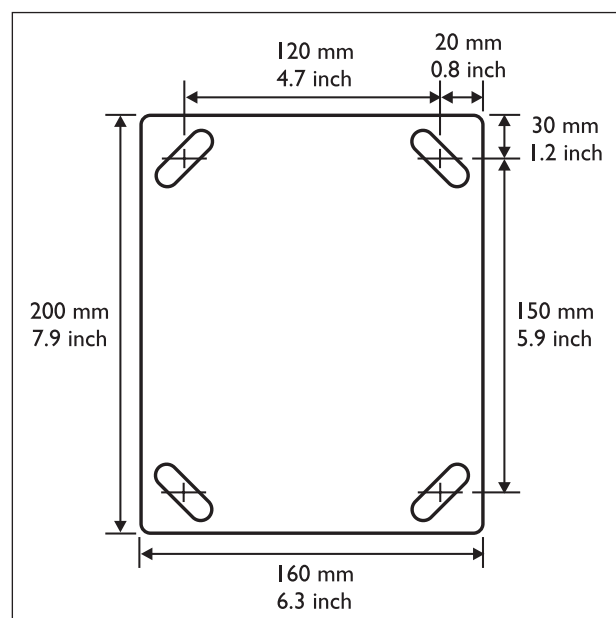


Figure 3.7 LBB 3414/00 wall mounting bracket showing dimensions and drilling pattern

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.

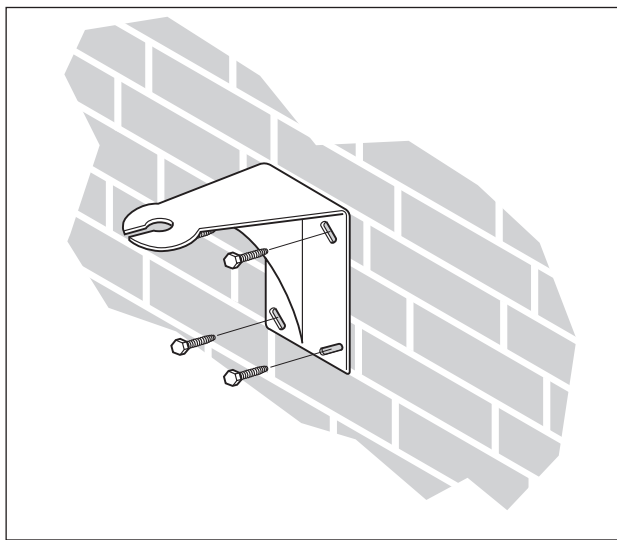


Figure 3.8 Attaching the wall mounting bracket to a wall

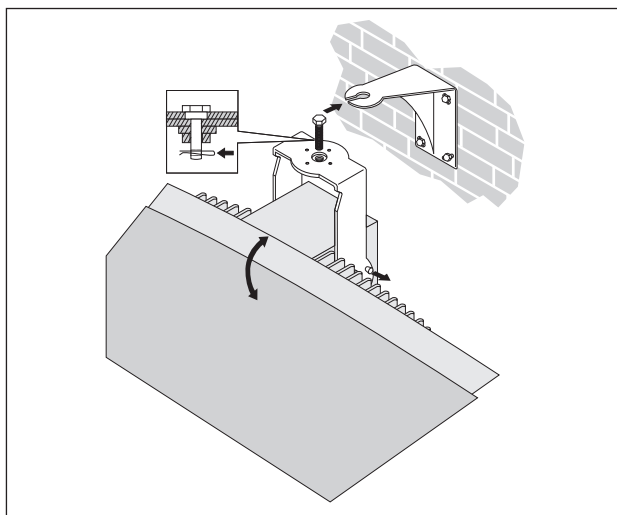


Figure 3.9 Attaching the radiator to the wall mounting bracket

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.

3.1.4 Connecting radiators to the transmitter

The transmitter has six BNC HF Output connectors labelled 1, 2, 3, 4, 5 and 6 on the rear panel. All six outputs are functionally identical. They can each drive up to 30 radiators (LBB 4511/00 and/or LBB 4512/00) in a loop-through configuration. The radiators are connected with RG59 cables. The maximum cable length per output is 900 m (2970 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.

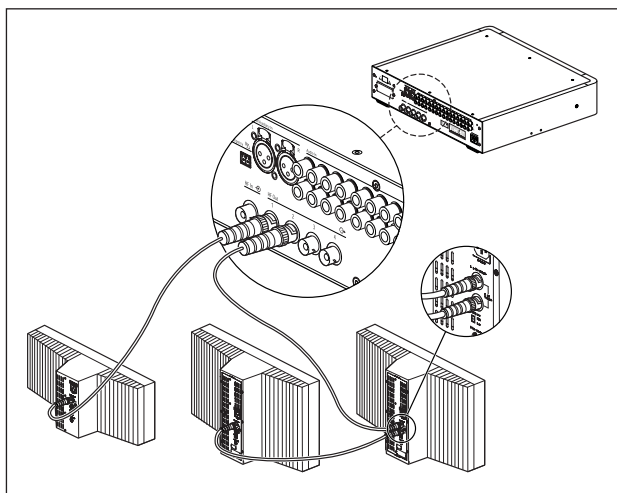


Figure 3.10 Loop-through connection of radiators

3.1.5 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.

3.2 Low Power Wide Beam Radiator

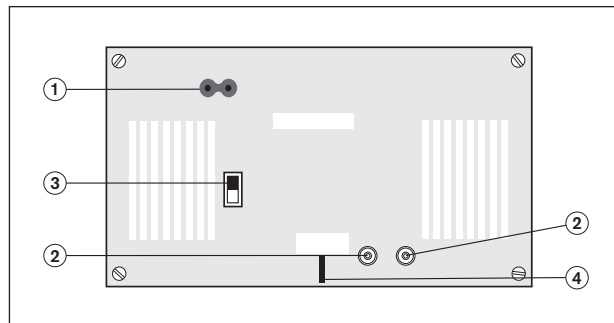
3.2.1 Description

This radiator is designed for small or medium-sized conference venues. The radiator has an infra-red output of 3 Wpp and they have a built-in power supply and are switched on automatically when the transmitter is switched on. A mains cable is provided. When not receiving carrier waves, the radiators switch to standby mode. They can be mounted on walls and ceilings or on a floor stand. Figures 3.11 and 3.12 show front and rear views of the radiators.

Figure 3.11 LBB 3410/05 Radiator (Front view)



Figure 3.12 LBB 3410/05 Radiator (Rear view)



1. **Male mains connector** - for connecting the radiator to the mains supply.
2. **HF BNC input and output connectors** - for connecting the radiator to the transmitter or for loop-through connection to other radiators.
3. **Power reduction switch** - reduces the output power of the radiator to 1.5 Wpp.
4. **Radiator mounting bracket.**

The following are found on the radiator printed circuit board: (Figure 3.13):

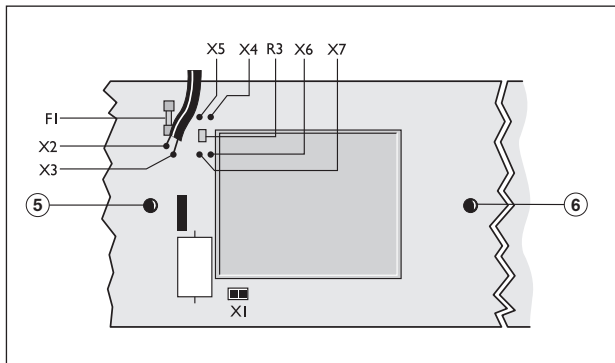


Figure 3.13 LBB 3410/05 Radiator (PCB)

5. **Green LED** - indicates that the radiator is switched on and is receiving carrier waves from the transmitter.
6. **Red LED** - indicates that the radiator output is 70% or less of the normal output level.

Mains voltage selection of 115 V or 230 V is internally selectable. On delivery the radiator is set for 230 V a.c. operation. To alter the mains voltage selection for the LBB 3410/05 radiators, it is necessary to solder two leads to contacts on the printed circuit board (PCB) inside the radiator. To locate the PCB, remove the four securing screws at the rear of the radiator and remove the unit from its housing. Remove the PCB from its mounting by removing the PCB's six securing screws and the small connector X1 (figure 3.13). To select 115 V operation, solder two small leads, one connecting X4 to X6 and one connecting X5 to X7. Then remove the small SMD resistor R3. When this is completed replace fuse F1 (160 mA) with a fuse rated at 350 mA.

Limitations:

- Not more than the first 4 carriers can be transmitted.
- Not more than 100 m cable length from transmitter to last radiator.
- Directly connection of the radiators to the transmitter with equal cable length. In loop-through connection, the total cable length from the first to the last radiator may not exceed 5 meters. Reason: there are no facilities on this radiator for compensating the cable signal delay.

- Don't use this radiator in combination with LBB 4511/00 and LBB 4512/00 radiators in one system, as the internal signal delay of these radiators are different.
- No automatic cable termination: the termination plug has to be connected to the last radiator in a trunk.
- No communication of the radiator status to the transmitter.
- Using this radiator at 105 to 125 V requires internal adjustments.

3.2.2 Radiator Status Indication

When the radiator is transmitting, a green LED mounted internally on a printed circuit board illuminates. If there is a failure in the radiator, a red LED illuminates on the printed circuit board.

3.2.3 Mounting the Radiator

Radiators in permanent installations can be fixed to a wall, hung under a ceiling or balcony or secured to any sturdy material using the unit's built-in bracket and mounting adaptor supplied with the radiator (figure 3.14). In non-permanent installations, a floor stand can be used. The mounting adaptor enables the radiator to be positioned for optimum performance.

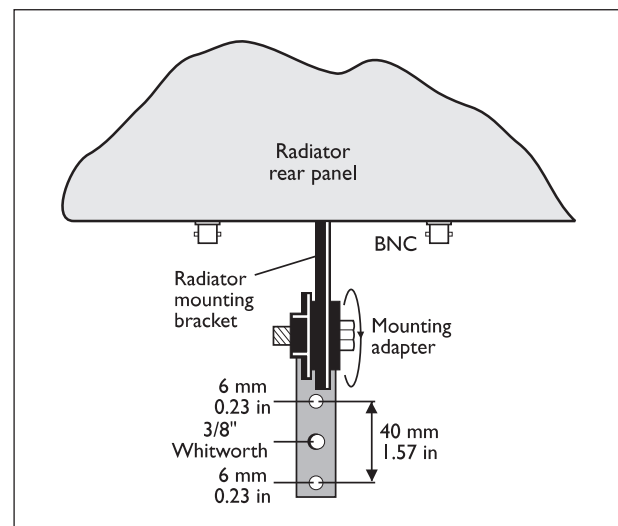


Figure 3.14 LBB 3410/05 Radiator Mounting

4 Integrus Receivers

4.1 Description

LBB 4540 receivers are available for 4, 8 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.

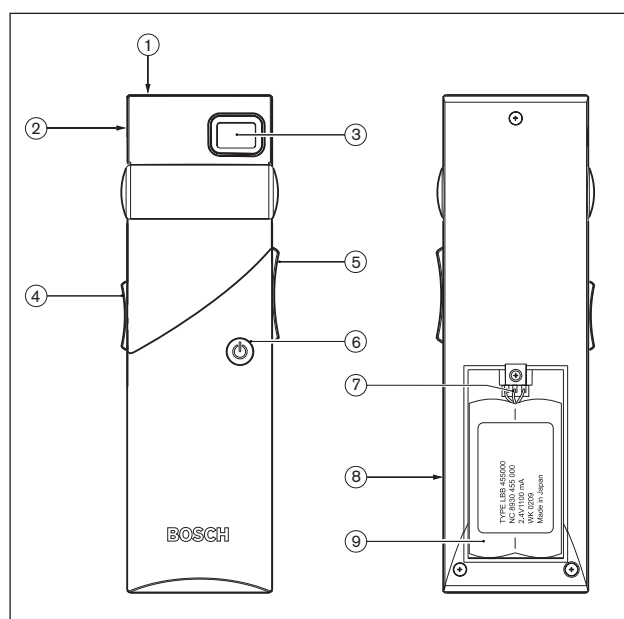


Figure 4.1 Receiver, front view and back view with open battery compartment

Charging circuitry is included in the receiver.

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 1.5 V 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 2.5.9).

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 (0-7) and then a quality indication (00-90).



Note: When the receiver does not receive the selected carrier, it keeps displaying the carrier number and does not display its quality.

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.
50-90	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 3441/10 Under the chin stereo headphones
- LBB3442/00 Single earphone (mono)
- LBB3443/00 Stereo headphones (recommended)
- Or any other compatible type (see chapter 7, Technical Data).

5 Integrus Charging Units

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 receivers with a LBB 4550/00 battery pack. You cannot charge other receiver types with the LBB 4560 charging units, nor can you use other charging units to charge LBB 4540 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.

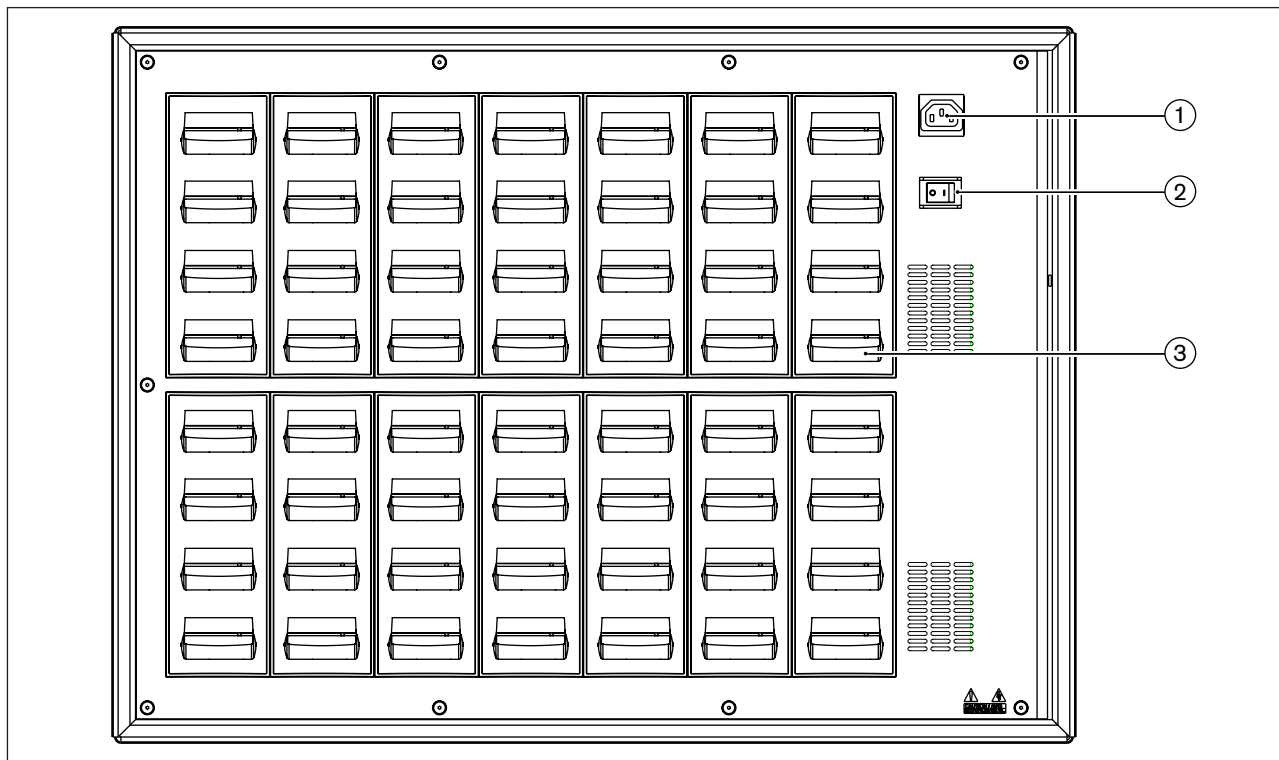


Figure 5.1 LBB 4560 Charging unit

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 CSA regulations, the charging cabinets must be mounted in such a way that they can be easily removed by hand in case of emergency.

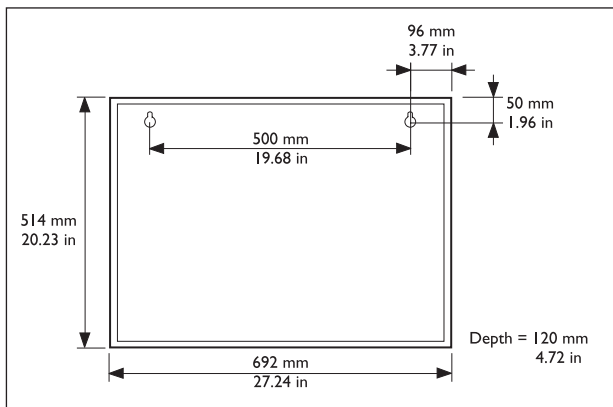


Figure 5.2 Charging cabinet mounting dimensions

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"> Check that the mains supply to the transmitter is connected and that the transmitter is switched on.
Transmitter indicates “no radiators”:	<ul style="list-style-type: none"> Ensure that connections to all radiators have been made correctly and that each radiator’s mains supply is connected and switched on.
Transmitter indicates “radiator fault”:	<ul style="list-style-type: none"> Ensure that connections to all radiators have been made correctly and that each radiator’s mains supply is connected and switched on. Examine the radiator LEDs.
Transmitter indicates “no network”:	<ul style="list-style-type: none"> Check that the optical network is connected correctly. Check that the control unit of the DCN Next Generation conference system is switched on or disable the network mode (menu 4B).
Transmitter indicates “network error”:	<ul style="list-style-type: none"> Enable the network mode (menu 4B) or disconnect the transmitter from the optical network.
Transmitter does not synchronise automatically to the maximum number of channels in DCN:	<ul style="list-style-type: none"> Ensure that the number of channels is set to automatic (using menu item 4B).
Emergency contact does not work:	<ul style="list-style-type: none"> Check that the emergency contact is connected correctly. Check that the audio is connected according to the selected auxiliary input mode (menu 4I).
Red LED flashes and amber LED is on of one or both IRED panels of a radiator:	<ul style="list-style-type: none"> IRED panel is in temperature protection mode. Check that the natural air-flow around that radiator is not obstructed. If not so, replace the radiator.
Both red LED and amber LED are on of one or both IRED panels of a radiator:	<ul style="list-style-type: none"> IRED panel malfunctions and the radiator should be replaced.
Infra red receiver fails to function properly:	<ul style="list-style-type: none"> If disposable batteries are used, check whether the batteries have sufficient capacity and whether they are inserted with the correct polarity. If a battery pack is used, ensure that the battery pack is fully charged. Ensure that the headphone is connected properly. Switch the receiver on and check whether the display indicates a channel. Ensure that the receiver picks up sufficient IR signal and check whether the antenna symbol becomes visible. Enable the mini radiator (menu 4M) and check the receiver by holding it in front of the mini radiator of the transmitter. Ensure that the volume control is turned up. Set the transmitter in test mode and check whether the test tone is audible on the receiver. 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).

Problem	Actions
The charging indicator LED on the receiver is blinking:	<ul style="list-style-type: none">• Check that the charging unit is used under the specified working conditions (see technical data).• Check that the receiver contains a battery pack which is connected correctly.• Ensure that the receiver is at room temperature and re-insert the receiver in the charging unit.• If the charging indicator starts blinking again, replace the battery pack and check whether the problem is resolved.
Receiver discharges very quickly:	<ul style="list-style-type: none">• Replace the battery pack and check whether the problem is resolved.
Bad coverage:	<ul style="list-style-type: none">• Do the tests as described in section 1.6.

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, according to IEC 61603 part 7 Carriers 6 and 7: up to 8 MHz
Protocol and modulation	DQPSK, according to IEC technique 61603 part 7

System Audio Performance

(Measured from the audio input of an INT-TX range transmitter to the headphone output of an INT-RX range receiver.)

Audio frequency response	20 Hz to 10 kHz (-3 dB) at Standard Quality 20 Hz to 20 kHz (-3 dB) at 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 (2,970 feet) per HF output.

System Environmental Conditions

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

7.2 Transmitters and Modules

7.2.1 Infra Red Transmitters

Physical Characteristics

Mounting	Brackets for 19" rack mounting or fixing to a table top Detachable feet for free-standing use on a table top
Dimensions (H x W x D)	92 x 440 x 410 mm (3.6 x 17.3 x 16.1 in) for table top use, without brackets, with feet 88 x 483 x 410 mm (3.5 x 19.0 x 16.1 in) for 19" rack use, with brackets, without feet 36 mm (1.4 in) in front of brackets, 372 mm (14,6 in) behind brackets
Weight	6.8 kg (15.0 lbs)
Finish	Charcoal with silver

Electrical Characteristics

Asymmetrical audio inputs	+3 dBV nominal, + 6 dBV Maximal (+/- 6 dB)
Symmetrical audio inputs	+15 dBV nominal, + 18 dBV Maximal (+/- 6 dB)
Emergency switch connector	emergency control input
Headphone output	32 Ohm to 2 kOhm
HF input	nominal 1 Vpp, 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 Transmitter Upgrade Kit range

Physical Characteristics

Mounting	Transmitter rear plate and mounting stub included
Dimensions (H x W x D)	325 x 220 x 26 mm (13 x 9 x 1 in)
Weight	425 g (0.95 lb)

Electrical Characteristics

See 7.2.1 INT-TX Transmitter range.

7.2.3 Integrus DCN interface module

Physical Characteristics

Mounting	Mounting plate and two screws included
Dimensions (H x W x D)	100 x 54 x 231 mm (39 x 21 x 91 in)
Weight	324 g (0.73 lb)

Electrical Characteristics

See DCN data brochure.

7.3 Radiators and Accessories

7.3.1 Medium and High Power Radiators

Physical Characteristics

Mounting	Suspension bracket for direct ceiling mounting 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) 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 0, 15, 30, 45, 60, 75 and 90° for wall/ceiling mounting.
Weight	LBB 4511/00 without bracket: 6.8 kg (15 lbs) LBB 4511/00 with bracket: 7.6 kg (17 lbs) LBB 4512/00 without bracket: 9.5 kg (21 lbs) LBB 4512/00 with bracket: 10.3 kg (23 lbs)
Finish	Bronze coloured

Electrical and Optical Characteristics

Number of IREDS	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
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 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

7.3.3 Low Power Wide Beam Radiator

Physical Characteristics

Mounting	Bracket for ceiling, wall and floor stand mounting with 3/8" Witworth thread
Dimensions (H x W x D)	176 x 300 x 125 mm (7 x 12 x 5 in)
Radiator angle	0° to 90° (without steps)
Weight	1.5 kg (3.3 lb)
Finish	Black

Electrical and Optical Characteristics

Number of IREDS	88
Total IR output	1.8 Wrms 3.0 Wpp
Total optical peak intensity	2.0 W/sr
Angle of half intensity	+/-24° vertical, +/-48° horizontal
Mains voltage	105 to 125 V or 220 to 240 V internally selectable, 50 to 60 Hz
Power consumption	25 VA
Power consumption (standby)	5 VA

7.4 Receivers, Battery Packs and Charging Units

7.4.1 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 ² 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 (battery voltage)
Power consumption at 2.4 V	15 mA (speech at maximum volume, 32 Ohm headphone)
Power consumption (standby)	< 1 mA

7.4.2 NiMH Battery Pack

Physical characteristics:

Dimensions (H x W x D)	14 x 28 x 49 mm (0.6 x 1.1 x 1.9 in)
Weight	50 g (0.11 lb)

Electrical characteristics:

Voltage	2.4 V
Capacity	1100 mAh

7.4.3 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

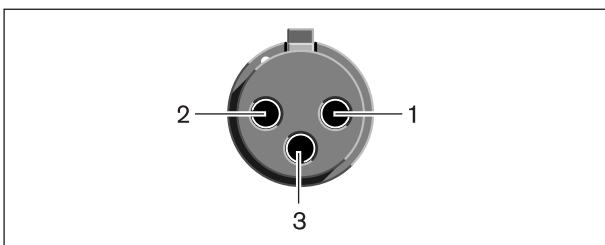
7.5.1 Mains cables

Blue	Neutral
Brown	Live
Green/Yellow	Earth/Ground

7.5.2 Audio cables

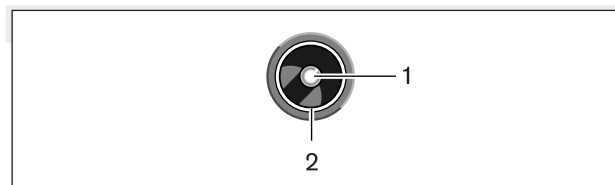
3-pole XLR connector (female)

Pin 1	Earth
Pin 2	Signal +
Pin 3	Signal -



Chinch connector (male)

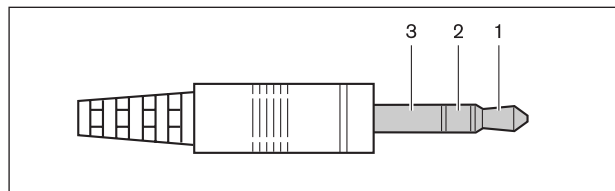
Pin 1	Signal +
Pin 2	Signal -



7.5.3 Earphones

3.5 mm Jack plug

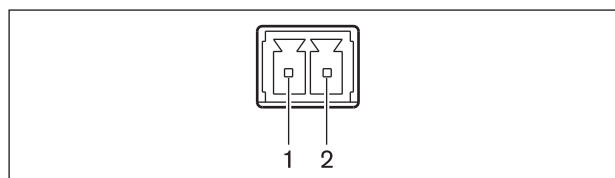
Tip (1)	Signal left
Ring (2)	Signal Right
Sleeve (3)	Electrical earth/screen



7.5.4 Emergency switch

Terminal block

Connect the emergency switch to pin 1 and 2.



7.6 Guaranteed rectangular footprints

number of carriers	mounting height [m]	mounting angle [degrees]	LBB 3410/05 at full power				LBB 4511/00 at full power				LBB 4512/00 at full power				
			area A [m ²]	length L [m]	width W [m]	offset X [m]	area A [m ²]	length L [m]	width W [m]	offset X [m]	area A [m ²]	length L [m]	width W [m]	offset X [m]	
1	2.5	0	130	13	10	4	627	33	19	7	1269	47	27	10	
		5	15	130	13	10	4	620	31	20	7	1196	46	26	8
	30		140	14	10	3	468	26	18	4	816	34	24	6	
	45		120	12	10	3	288	18	16	2	480	24	20	2	
	60		100	10	10	1	196	14	14	0	324	18	18	0	
	90		56	7	8	-4	144	12	12	-6	196	14	14	-7	
	10	15					589	31	19	9	1288	46	28	10	
		30	72	9	8	7	551	29	19	5	988	38	26	6	
		45	90	9	10	4	414	23	18	2	672	28	24	2	
		60	108	12	9	0	306	18	17	-1	506	23	22	-1	
		90	80	8	10	-5	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	63	9	7	2	308	22	14	4	576	32	18
	5			15	63	9	7	3	322	23	14	5	620	31	20
			30	56	8	7	3	247	19	13	3	468	26	18	4
45			49	7	7	1	168	14	12	1	288	18	16	2	
60			49	7	7	0	132	12	11	-1	196	14	14	0	
90			42	6	7	-3	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		30	5	6	2	195	15	13	-1	306	18	17	-1	
	90		42	6	7	-3	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	20	5	4	2	160	16	10	3	308	22	14	4
			5	15					144	16	9	4	322	23	14
	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
	5			15					60	10	6	4	144	16	9
			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).

number of carriers	mounting height [feet]	mounting angle [degrees]	LBB 3410/05 at full power				LBB 4511/00 at full power				LBB 4512/00 at full power				
			area A [feet ²]	length L [feet]	width W [feet]	offset X [feet]	area A [feet ²]	length L [feet]	width WX [feet]	offset A [feet]	area L [feet ²]	length W [feet]	width X [feet]	offset [feet]	
1	8	0	1419	43	33	13	6696	108	62	23	13706	154	89	33	
		15	1419	43	33	13	6732	102	66	23	12835	151	85	26	
	16	30	1518	46	33	10	5015	85	59	13	8848	112	79	20	
		45	1287	39	33	10	3068	59	52	7	5214	79	66	7	
		60	1089	33	33	3	2116	46	46	0	3481	59	59	0	
		90	598	23	26	-13	1521	39	39	-20	2116	46	46	-23	
		33	15					6324	102	62	30	13892	151	92	33
			30	780	30	26	23	5890	95	62	16	10625	125	85	20
	45		990	30	33	13	4425	75	59	7	7268	92	79	7	
	60		1170	39	30	0	3304	59	56	-3	5400	75	72	-3	
	66	90	858	26	33	-16	2704	52	52	-26	4356	66	66	-33	
		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	
	2	8	15	690	30	23	7	3312	72	46	13	6195	105	59	20
			16	690	30	23	10	3450	75	46	16	6732	102	66	23
16		30	598	26	23	10	2666	62	43	10	5015	85	59	13	
		45	529	23	23	3	1794	46	39	3	3068	59	52	7	
		60	529	23	23	0	1404	39	36	-3	2116	46	46	0	
		90	460	20	23	-10	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			320	16	20	7	2107	49	43	-3	3304	59	56	-3	
66		90	460	20	23	-10	1521	39	39	-20	2704	52	52	-26	
		60					2107	49	43	10	4464	72	62	3	
		90					2116	46	46	-23	3481	59	59	-30	
4		8	15	208	16	13	7	1716	52	33	10	3312	72	46	13
			16					1560	52	30	13	3450	75	46	16
		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	
		90					2116	46	46	-23	3481	59	59	-30	
	8	8	15					897	39	23	7	1716	52	33	10
			16					660	33	20	13	1560	52	30	13
		16	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).

Product index

Transmitters

INT-TX04	4-channel transmitter	15
INT-TX08	8-channel transmitter	15
INT-TX16	16-channel transmitter	15
INT-TX32	32-channel transmitter	15
INT-TXK04	4-channel transmitter upgrade kit	18
INT-TXK08	8-channel transmitter upgrade kit	18
INT-TXK16	16-channel transmitter upgrade kit	18
INT-TXK32	32-channel transmitter upgrade kit	18

Interface module

LBB 3423/20	Integrus DCN interface module	16
-------------	-------------------------------	----

Radiators

LBB 4511/00	Medium-power radiator	42
LBB 4512/00	High-power radiator	42
LBB 3414/00	Wall mounting bracket	44
LBB 3410/05	Low power wide beam radiator	46

Receivers

LBB 4540/04	4-channel pocket receiver	48
LBB 4540/08	8-channel pocket receiver	48
LBB 4540/32	32-channel pocket receiver	48
LBB 4550/00	Rechargeable NiMH battery pack	48

Headphones

LBB 3441/10	Under the chin stereo headphones	49
LBB 3442/00	Single earphone (mono)	49
LBB 3443/00	Stereo headphones	49

Charging units

LBB 4560/00	Charging suitcase	50
LBB 4560/50	Charging cabinet	50

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