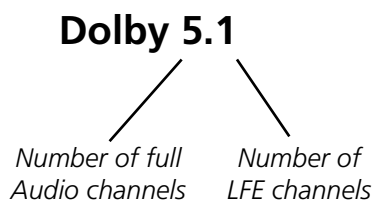


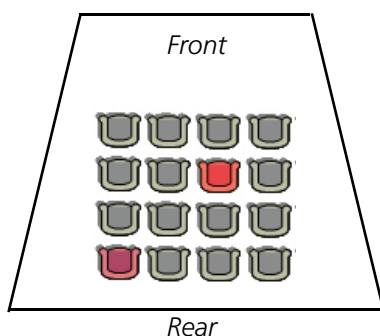
How to set the Sound of Home Cinema Installations



Today's home cinema installations commonly include a Dolby surround sound system. For example a Dolby 5.1 describes the configuration with 5 full audio channels (left, centre, right, left surround, right surround) and one LFE channel (=Low Frequency Effects channel). The LFE channel originates from the cinema world with its rumbling bomb explosions and dinosaur stomps. These special sound effects are generated by a sub woofer covering the frequency range 20Hz- 120 Hz.

You may follow these guidelines to optimize the surround sound performance of a home cinema installation.

1. How to design the Room for the Home Cinema?

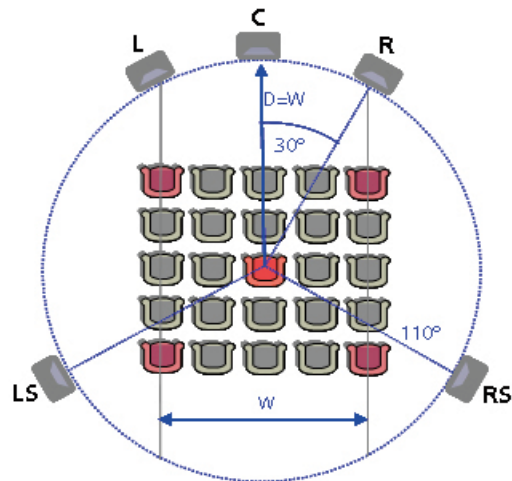


Listeners enjoy best sound performance from the direct speaker sound. Any additional reflections from walls, floor or ceilings irritates the directional perception of the sound source, thus the complete surround sound image worsens. The basic guideline for the architectural room design is to follow the common cinema approach:

- The side walls are not parallel, they are widening from the front to the rear. This design leads any sound reflections from the side wall directly to the rear wall.
- Sound absorbing treatment at the rear wall
- The ceiling is not parallel to the floor
- Carpets on the floor, curtains on the walls
- Prevent any hard, solid reflection materials, such as glass
- Seating areas made by cushioned seats instead of hard wooden chairs-

2. How to Setup the Surround Sound System

You may align the speakers along the perimeter of a circle around the main seating position. In case of space restrictions the speaker arrangement shall be as close as possible to the circle alignment for best sound performance.



Dolby 5.1 Layout

The speaker height is best slightly above the listener's ears, e.g. 130-140 cm. The LFE sub woofer positioning is not crucial, as bass sound is non-directional. Commonly the LFE is situated near the centre speaker.

3. How to commission the Home Cinema Installation



Requirements:

- Digirator DR2 with extended file set (from the DVD)
- Acoustilyzer AL1
- MiniSPL measurement microphone
- Minirator MR-PRO
- Microphone stand
- 1m XLR audio cable

Some AV amplifiers complete a basic commissioning automatically. The resulting sound performance refers to a certain person's perception. This guideline supports customized settings meeting your individual requirements.



Digirator DR2

The NTI Digirator DR2 generates surround sound test sequences for verification and adjustment of professional Dolby and DTS installations. The Acoustilyzer in combination with the MiniSPL measurement microphone forms a comprehensive class 2 acoustical analyzer. The DR2 and the AL1 together is an ideal couple to enhance the home cinema sound performance.

The recommended tests for a home cinema installation are:

- Basic Performance Test
- Polarity
- Frequency Response at different listening positions
- Sound Pressure Level
- Delays
- Crossovers

You may document all test results to your PC for backup and verification later on.

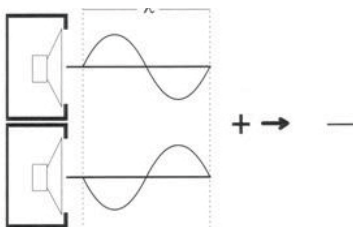


Home Cinema Test Configuration

Basic Performance Test

- Set the A/V amplifier gain to minimum.
- Connect the Digirator to the A/V amplifier input.
- Position the MiniSPL measurement microphone with a microphone stand at the main seating position in the typical height of the listeners head and connect the Acoustilyzer directly or by a XLR cable.
- Acoustilyzer: Select: SPL/RTA, SPL Mode, C-WTD
- Digirator: Select DOLBY -> D_51 -> PNOISE_L (pink noise signal at left channel)
- Increase the A/V amplifier gain up to the typical listening level in the main seating position, e.g. 75 dB SPL.
- Measure and adjust the basic sound pressure level of the other speakers in the same manner.

Speaker Polarity



Opposite polarity results in cancellations

The polarity test verifies the correct cable and speaker polarity. Wrong polarity may mask sound or even cancel out some frequency ranges. Some loudspeaker manufacturers purposely design a speaker for negative polarity inside the speaker box for better sound performance. In case you observe different polarities (e.g. left speaker = negative) please ensure that the same characteristics is measured at the opposite speaker (right speaker = negative).

Please verify the speaker cabling at different polarity readings of left/right speaker or left/right surround speaker.

- Position the MiniSPL measurement microphone with a microphone stand at the main seating position in the typical height of the listeners head and connect the Acoustilyzer directly or by a XLR cable.
- Acoustilyzer: Select: Polarity -> XLR/RCA
- Digirator: Select DOLBY -> D_51 -> POLARI_L (polarity signal at left channel)
- Measure the speaker polarity
- Measure the polarity of the other speakers in the same manner.

Frequency Responses at different seating positions

The frequency response differs at every seating position. In order to optimize the sound characteristic for all seating positions you may take readings at different seats and average the results.

- Acoustilyzer: Select the SPL/RTA -> RTA Mode, 1/3 octave resolution
- Digirator: Select DOLBY -> D_51 -> PNOISE (pink noise signal at all channels)
- Measure the frequency response at the main seating position and save the result into the internal memory.
- Move the microphone to an outside corner seat and repeat the RTA measurement. Log the result into the internal memory.
- Measure and log the frequency response of the other seats in the corners in the same manner.
- Calculate the averaged frequency response of all measurements on the Acoustilyzer (see MEM menu) and adjust the system equalizer for a smooth frequency response without sudden peaks or bumps. Thus an optimized and averaged sound performance for all seating positions can be achieved.
- Repeat the measurement once at all positions to verify your EQ settings.

Sound Pressure Level

All speakers shall provide the same sound pressure level at the main seating position.

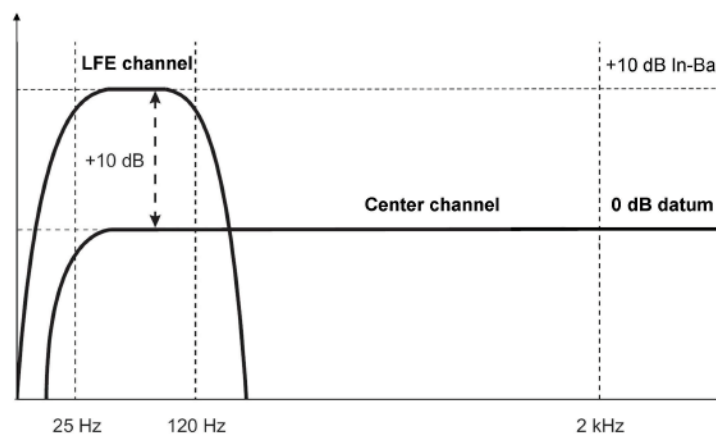
- Position the MiniSPL measurement microphone with a microphone stand at the main seating position in the typical height of the listeners head and connect the Acoustilyzer directly or by a XLR cable.
- Acoustilyzer: Select: SPL/RTA, SPL Mode, C-WTD
- Digirator: Select DOLBY -> D_51 -> PNOISE_L (pink noise signal at left channel)
- Set the sound pressure level to 75 dBSPL +/-0.5dB at the gain setting of the A/V amplifier
- Measure and adjust the sound pressure level of the other speakers to 75 dBSPL +/-0.5dB in the same manner.
- Note the typical sound pressure level at 1 kHz displayed in the RTA mode. This reading is required for the LFE level setting.



Acoustilyzer AL1 with MiniSPL measurement microphone

We remember the LFE channel is tailored for the rumbling bomb explosions and dinosaur stomps. The LFE sound pressure level shall be about 10dB higher than the surround level within the typical LFE frequency range 20 Hz - 120 Hz.

- Digirator: Select DOLBY -> D_51 -> PNOI_LFE (pink noise signal at LFE channel)
- Acoustilyzer: Select: SPL/RTA, RTA Mode, C-WTD
- Measure the sound pressure level of the LFE sub woofer in the lower frequency bands 20Hz - 120Hz. The setting shall be about 10dB higher than the 1 kHz reading at the full audio channels.



Level alignment of LFE and surround sound speakers

Delays

The sound of all surround sound speakers shall arrive at the same time at the main seating position.

- Connect the Minirator MR-PRO to the analog input.
- Select DELAY (delay test signal)
- Acoustilyzer: Select Delay test function and synchronize the XLR input to the reference delay signal.
- Measure the delay time at the main seating position for the left speaker.
- Measure the delay of the other speakers in the same manner and adjust the same delay time at all speakers.

Crossovers

- Acoustilyzer: Select the SPL/RTA -> RTA Mode, 1/3 octave resolution
- Digirator: Select DOLBY -> D_51 -> PNOISE (pink noise signal at all channels)
- Verify the sound spectra at the crossover frequency.
- Any dips or bump shall be smoothed out for flat response by setting the sub woofer phase or crossover frequency.

Customize Settings

You may customize the surround sound performance by the equalizer according your personal perception.

- Listen to a typical surround sound audio sequence
- Carry out some minor adjustments of the equalizer for your preferred sound settings, e.g. more lows or more highs.