

LoLa audio info sheet (mdw, March 2022)

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Please provide any feedback about this manual to Robert (hofmann@mdw.ac.at)

1. General Information

The main goal for LoLa, and therefore our job as technicians, is to enable natural communication between people – in our case musicians – from remote locations, as if they were in the same room. Indeed it was reported countless times that after a few minutes of getting used to the system, participants almost forgot that their counterpart was hundreds of kilometres away. This is to be considered a successful application of LoLa.

Regarding sound, we have to keep in mind that through LoLa, two physical rooms are acoustically connected, and their acoustics therefore intermingle. The microphones in the first room pick up the room's own reverb, and when this is played back at the remote end, the reverb of the second room is added to it. To minimise this effect, we place the microphones closer to the instruments than we would do in a standard recording environment, more like it is done for reinforcement on the concert stage.

It is also important to set the loudspeakers as quietly as possible, to minimise the feedback of one's own signal through LoLa. In jazz contexts, and sometimes even with classical music, it is possible to use headphones instead of speakers. If this is comfortable for the musicians, it is always preferable because it makes the signal much clearer and more direct.

The processing of the audio (equalisation, panning, mixing and optional reverb) should always be done at the receiving end. Therefore all channels have to be transmitted unprocessed. This means the microphones should either be plugged into a mixing desk and sent post-gain, or straight into the audio interface. Make sure that the signals are sent at a reasonable level, but with enough headroom (~10dB). If possible, every microphone should be sent on a separate channel, so the mix can be influenced at the receiving end, based on the acoustics and type of speakers.

Whenever the instrument's playing volume is much louder than speaking level (like with a trumpet), or when the microphones are placed quite far away from the musician (as with a piano), a separate talkback microphone should be used. This microphone has to be muted whenever the instrument is playing. If a separate audio channel is used, this can be done by the technician on the receiving end. Another option is to use a foot pedal that is operated by the musician and pressed down whenever they want to speak. We are currently preparing a video that will explain this process.

2. Microphone recommendations

In most cases, the best option is to use high quality condenser microphones. Depending on the instrument, they should have a polar pattern of either cardioid or hyper-cardioid.

Here are some recommendations for microphones:

	€	€€	€€€
cardioid	Røde NT5	Neumann KM184	Sennheiser MKH 8040
hyper-cardioid	Sennheiser E614	Neumann KM185	Sennheiser MKH 8050

As talkback microphones, we can use either lapel or headset microphones, or gooseneck speech microphones. These options are better suited than dynamic microphones because they allow the musician to speak freely, without having to think about staying close to the microphone.

3. Instrument specific information

3.1 Microphone placement for classical music

3.1.1 Piano

Microphone type: condenser (cardioid)

Number of microphones: 2

Position: 20-30 cm above the sound board, angle of 20-30° to the strings

Additional talkback microphone: yes

It is best to use two cardioid microphones. Place one microphone right in the bend of the piano's body, pointing to the high strings. The microphone should be between 20 cm and 30 cm above the sounding board, with an angle of 20-30° to the strings. Make sure the microphone is placed in front of the piano and is not reaching inside the piano, as this causes an unwanted colouration of the sound due to the absence of reflections from the lid. Standing in front of the piano, place the second microphone to the right side of the first microphone, about two thirds along the length of the longest string. It should be pointing to the low strings, also with an angle of 20-30°.

Please use a separate talkback microphone.



3.1.2 Violin / viola

Microphone type: condenser (hyper-cardioid)

Number of microphones: 1

Position: about 60-80 cm distance, left side, slightly above the instrument.

Additional talkback microphone: yes

For violin and viola, hyper-cardioid microphones are recommended. Looking onto the player from the back, place the microphone on the left side of the instrument, slightly higher than the instrument and pointing down towards it (see pictures). This position will provide the most balanced sound over the whole frequency spectrum. Placing the microphone in front of the instrument often results in a screeching sound with no body.

Please use a separate talkback microphone from the front.



3.1.3 Cello

Microphone type: condenser (cardioid)

Number of microphones: 1

Position: about 30 cm distance, 5-10 cm below the f-hole

Additional talkback microphone: yes

For cello, use a cardioid microphone. Place it around 30 cm away from the instrument, on the right-hand side, halfway between the bridge and the f-hole, and about 5-10 cm below.

Please use a separate talkback microphone.



3.1.4 Double bass

Microphone type: condenser (cardioid)

Number of microphones: 1

Position: about 40 cm away

Additional talkback microphone: yes

When choosing a microphone position for the double bass, we are balancing the lower frequencies, the body of the instrument, with the higher frequencies, which are more important for the attack of the notes. The closer and more level with the f-holes the

microphone is, the more the low frequencies will be emphasised. The nearer we position it to where the fingers and the bow touch the strings, the more prominent the high frequencies will be. Place the microphone about 40 cm away and a little bit to the right side of the instrument, somewhere between the f-holes and the bridge.

Please use a separate talkback microphone.

3.1.5 Solo woodwinds

Microphone type: condenser (hyper-cardioid)

Number of microphones: 2

Position: above the music stand, about 40 cm away

Additional talkback microphone: no

For the best sound even when the player is moving slightly, use two hyper-cardioid microphones. Place them on a stereo bar (10-15 cm) directly above the music stand, parallel to each other, pointing to the upper third of the instrument. Make sure the music stand is angled steeply to avoid reflections of the sound from the music stand into the microphone. Avoid pointing the microphone to the bell of the woodwind instrument, as this can result in a blurry, dark and unnatural sound.



3.1.6 French horn

Microphone type: condenser (cardioid)

Number of microphones: 1

Position: In front of the horn, approx. 40 cm distance

Additional talkback microphone: yes

Even though the bell is on the back of the instrument, we do not place the microphone there because it would not achieve the typical sound the horn is known for. After all, the listener is used to sitting in front of the instrument. Depending on the acoustics of the room, a distance from microphone to instrument of approximately 40 cm is suitable. If the sound is unnaturally muffled, we can build a reflective wall behind the instrument, for example using an upturned table. Aim the microphone in the direction of the lead pipe. As brass instruments can get very loud, be careful not to overload the microphone preamps.



Please use a separate talkback microphone.

3.1.7 Trumpet / trombone

Microphone type: condenser (cardioid)

Number of microphones: 1

Position: not directly in front of the bell, slightly off-axis, at least 30 cm distance

Additional talkback microphone: yes

For a well-balanced sound with a trumpet or trombone, it is recommended to place the microphone not directly in front of the bell, but slightly off-centre, as the sound gets too bright and harsh otherwise. Choose a distance of at least 30 cm to the instrument, as the trumpet is a very loud and dynamic instrument that can take some microphones to their limits.



Please use a separate talkback microphone.

3.1.8 Tuba

Microphone type: condenser (cardioid)

Number of microphones: 1

Position: 20-30 cm on the side of the bell, off-axis

Additional talkback microphone: yes

Place the microphone at a distance of 20-30 cm from the bell, off-centre towards the side.

Please use a separate talkback microphone.

3.1.9 Percussion

Microphone type: condenser (cardioid)

Number of microphones: 2

Position: 40-70 cm away

Additional talkback microphone: yes

For percussion instruments, use two cardioid microphones in a stereo setup. Place it about 40-70 cm above from the instruments and use a stereo width of 30-100 cm, depending on the width of the percussion setup. If there are instruments included that are very quiet, or too far from the overhead microphones, use additional condenser or dynamic microphones to capture their sound.

Please use a separate talkback microphone.

3.1.10 Solo voice

Microphone type: condenser (hyper-cardioid)

Number of microphones: 1 or 2

Position: about 50 cm away

Additional talkback microphone: no

It is best to use hyper-cardioid microphones, as these will give the best signal to room ratio and will minimise room reflections. If using one microphone, place it directly above the music stand, pointing to the singer's head. Make sure the music stand is angled steeply to avoid reflections of the sound from the music stand into the microphone. For best sound even when the singer is moving slightly, use two hyper-cardioid microphones on a stereo bar, with a distance of about 25 cm.



3.1.11 Guitar

Microphone type: condenser (hyper-cardioid), alternatively: ribbon mics

Number of microphones: 2

Position: about 20-30 cm away

Additional talkback microphone: no

Use two microphones, either condenser or ribbon. Looking onto the instrument, place the first microphone on the left side of the sound hole. It should be about 10 cm to the left, at a distance of about 20 to 30 cm. The height of the microphone should be chosen so that it points to the strings with an angle of about 30° or 40° upwards. This will capture the lower frequencies of the guitar and provide body and fullness. Place the second microphone between 20 and 30 cm to the right side of the sound hole and set the height of it so it points to the strings with an angle of 30° or 40° downwards.

If there is more than one guitar, use one microphone for each instrument, at a distance of 20-30 cm. It should be about as high as the sound hole, but placed about 10 cm away from it, pointing to the body of the guitar, just below the 14th fret.



3.1.12 Harp

Microphone type: condenser (cardioid)

Number of microphones: 1 or 2

Position: about 20-30 cm away

Additional talkback microphone: yes

It is possible to capture the sound of a harp either with one or two microphones. If you choose the mono option, we recommend placing a condenser microphone above the soundboard, at a distance of 20-30 cm. If the sound is too muddy, try to move the microphone away from the soundboard, more in the direction of the center of the harp.

In a stereo setup, place one microphone closer to the soundboard, and the other one about 20 cm from the first microphone up the soundboard, pointing towards the strings. Be careful not to get in the way of the player's hands.



Please use a separate talkback microphone.

3.1.13 Harpsichord

Microphone type: condenser (cardioid), alternatively: ribbon mics

Number of microphones: 2

Position: about 40 cm away

Additional talkback microphone: yes

Use two microphones, either condenser or ribbon, on a stereo bar with a width of about 20 cm. Place them right in the bend of the harpsichord's body, pointing to the centre of the instrument, between the high and the low strings. The microphones should be about 20 to 30 cm above the sounding board and have an angle of 20° to 30° to the strings. Make sure the microphones are placed in front of the harpsichord and are not reaching inside the instrument.



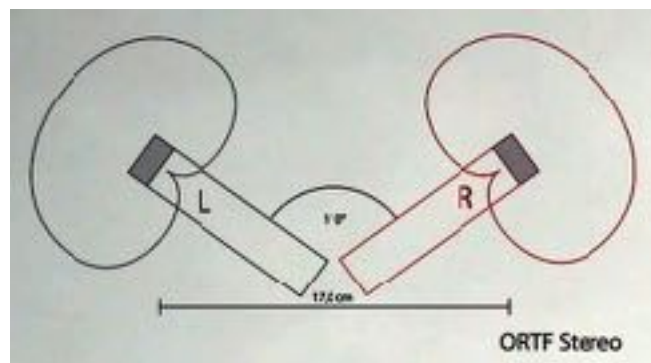
Please use a separate talkback microphone.

3.2 Microphone placement for ensembles

For ensembles, there are always two options: using a separate microphone for each instrument, or using a stereo system to capture the whole ensemble.

If you choose spot microphones, you can use the recommendations for the specific instruments mentioned earlier.

As a stereo setup, you can use two microphones on a stereo bar (ORTF setup, 17 cm / 110°) placed in front of the ensemble, between 1 and 2 metres high and between 1 and 2 metres away from the ensemble.



3.3 Microphone placement for pop & jazz music

3.3.1 Piano

Microphone type: condenser (cardioid)

Number of microphones: 2

Additional talkback microphone: yes

Besides the already mentioned microphone position (3.1.1), for pop & jazz music there are many other options to achieve a closer, more direct piano sound. One of them, to get a more percussive sound, is to place the microphones about 40 cm apart, very close (about 15 cm) to the hammers. Especially for jazz music, it is also possible to use the two microphones on a stereo bar (ORTF setup, 17 cm / 110°) and position them 30-40 cm above the strings, pointing at them in a 45° angle.

Please use a separate talkback microphone.

3.3.2 Keyboards

Microphone type: XLR line outs / DI box

Number of microphones: –

Additional talkback microphone: yes

The sound of an electric piano or synthesiser can be used directly via the line outputs of the instrument, using a DI box if necessary. Be aware that this signal is likely much louder than a normal microphone signal and probably has to be lowered when plugged into a pre-amp.

In this case, a talkback microphone is essential.

3.3.3 Electric guitar

Microphone type: dynamic (cardioid)

Number of microphones: 1

Position: 1-5 cm distance to the speaker

Additional talkback microphone: yes

Use a dynamic microphone (like a Shure SM57) at a distance of only 1-5 cm to the guitar amp's speaker. The more you point or move the microphone to the centre of the speaker, the louder the high frequencies and the harsher the sound will get.

Please use a separate talkback microphone.

3.3.4 Electric bass

Microphone type: dynamic (cardioid) / DI box

Number of microphones: 1 / –

Position: 1-5 cm distance to the amp / –

Additional talkback microphone: yes

While it is possible to capture electric bass via the amp, like with an electric guitar, it is also common to use a DI box, or get the signal directly from the amp, if it has a direct XLR out. Recommended microphones are the Shure SM57, Sennheiser MD421 or the Electrovoice RE20. When using a direct out or DI box, be aware that the signal might be much louder than a normal microphone signal and probably has to be lowered when plugged into a pre-amp.

Please use a separate talkback microphone.

3.3.5 Double bass

Microphone type: dynamic (cardioid), alternatively: pickup microphone

Number of microphones: 1-2

Position: 20-30 cm or pickup at/near the bridge

Additional talkback microphone: yes

Use a dynamic cardioid microphone (like a Shure SM57). Place it about 20 cm in front of one of the f-holes, slightly above the bridge and pointing slightly below the f-hole. Alternatively or in addition, we can use a pickup microphone (like the dpa 4099) at the bridge.

Please use a separate talkback microphone.

3.3.6 Drums

Microphone type: dynamic and condenser microphones (cardioid)

Number of microphones: 2-4

Position: overheads, bass drum, snare

Additional talkback microphone: yes

Use a stereo overhead microphone setup placed 60-80 cm above the drum kit, facing down, with a distance of 80-120 cm between the microphones, depending on the size of the drum kit. While this setup is capturing the sound of the whole kit, it will improve the sound a good deal to use additional spot microphones for bass drum and snare drum. The bass drum microphone should be placed 5 cm in front of the resonant head, or its

hole. Use a suitable dynamic microphone as bass drum spot microphone (AKG D112, Shure Beta 52A, EV RE-20). The snare drum microphone (SM57) can be positioned close to the rim of the snare, 5 cm away from its membrane, pointing towards the middle of the drum head.

Please use a separate talkback microphone.

3.3.7 Voice (pop music)

Microphone type: big diaphragm condenser mic (cardioid), or dynamic (cardioid)

Number of microphones: 1

Position: 5-15 cm, pop filter recommended when using condenser mic

Additional talkback microphone: no

For solo voice, place the microphone about 5-15 cm away from the singer and use a pop filter to absorb unwanted noises. We recommend using a large diaphragm condenser microphone like the Neumann U87, Neumann TLM170, or any of their less expensive alternatives. There are also lots of different dynamic vocal microphone models, like the Shure SM87.

3.3.8 Saxophone

Microphone type:, condenser (cardioid or hyper cardioid)

Number of microphones: 1

Position: 15 cm distance, on the left side of the body

Additional talkback microphone: no

Similar to other woodwinds, it is not advised to place the microphone right in front of the bell of the instrument. Rather, move the microphone up about 15 cm, and angle it towards the body of the instrument.

4. Processing (at the receiving end)

4.1 General processing

The most important rule is to always mute the incoming talkback microphones whenever instruments are playing. When the talkback is sent on a separate channel, this is the job of the sound engineer at the receiving end.

Whenever possible, use headphones to prevent feedback of the received signal into the microphones. When using speakers, start off at a low volume and increase only if needed. The sound engineer should always try to set the sound to a relatively low level, but at the same time make sure that everyone can still hear everything clearly.

If an audio feedback occurs, lower the volume of the speakers first to see if that solves the problem. If there is a specific frequency feeding back, it is also possible to filter it out of the signal with a very narrow EQ.

4.2 Reverb settings

When using only spot microphones and an artificial reverb, it can be hard to create a natural sound because there is a lot of direct sound from the instrument in the signal, but not enough diffuse sound from the room. To create a more natural dissipation effect, make sure to lower the high frequencies in the reverb settings. We recommend a shallow high-cut at about 2600 Hz. Use pre-delay times between 12 and 25 ms, and lower the volume of the early reflections. Reverb times between 1.7 and 1.9 s should be sufficient.

4.3 EQ and panorama

Piano:

EQ: reduce at 120 Hz if the sound is too boomy. If too bright, reduce at around 5 kHz. Use broad Q-values around 0.5 to 0.7.

Pan: pan 'piano treble' 30% to the right, pan 'piano bass' 60% to the left.

Solo woodwind/solo voice:

EQ: use a low-cut at 100-120 Hz to reduce unwanted low frequencies and noise. For extra intelligibility use a slight boost of max 2-3 dB with Q about 0.6 at 3500 Hz.

Pan: for mono, pan the one microphone to centre, for two microphones, use hard LR panning.

Guitar:

EQ: use a low-cut at 100-120 Hz to reduce unwanted low frequencies and noise. Reduce at 500 Hz with a sharp Q if you hear unpleasant resonances.

Pan: when using single microphones, pan them to match the ensemble. For one stereo guitar, pan the two microphones to hard left and hard right.

Solo strings:

EQ: use a low cut at 100-120 Hz to reduce unwanted low frequencies and noise. If the sound is too dull, give a slight boost (not more than 1.5 dB) at 3500 Hz with a Q of 0.6.

Pan: as the ensemble requires.

5. Video

Make sure that the main camera is at the same position as the screen and as close to it as possible, to enable eye contact and proper communication between the two locations. The standard position would be in the centre of the screen, just above it. If the player or teacher is seated, especially when they often look down to a score, it is often best to have the camera below the screen, maybe even slightly reaching into the screen.



A second camera can be useful to show, for example, the keyboard of a piano, or for close-ups of a body position or fingering details. At this stage (LoLa 2.0), the switching between the cameras has to be done by the technician.

For larger ensembles, it will be necessary to use wider lenses (with a focal length of about 8 mm) so that the whole ensemble fits into the frame without the camera having to be too far away.

Please provide any feedback about this manual to Robert (hofmann@mdw.ac.at)