Sphere L22

Precision Microphone System



Hardware and Software Guide

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Townsend
Labs Inc

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Chapter 1: Introduction

Thank you for choosing the Sphere L22™ Precision Microphone system as part of your musical creative process. Developing the Sphere L22 has been a labor of love for those of us at Townsend Labs, and we hope you enjoy using it as much as we did designing and building it.

At its heart, the Sphere L22 is a precision, high-quality, large-diaphragm condenser microphone. When combined with the included Townsend Labs Sphere DSP modeling plug-in (VST, AAX, AU, UAD), it offers numerous advanced features that place it well beyond the capabilities of any currently available mic. Most notably, it accurately models a wide range of the most sought after vintage and modern microphones.

Previous mic modeling technologies apply EQ to filter sound from what is essentially a conventional mic. This is fundamentally the same as using EQ to process a recorded track, which is inherently limited in how the sound can be affected. In contrast, the Sphere L22 mic has two capsules, each with its own output, which more completely captures the directional and distance information otherwise lost with a conventional single-channel mic. This additional information lets the Townsend Labs Sphere DSP plug-in reconstruct how different mics respond to the soundfield.

Feature Summary

The Sphere L22 Precision Microphone System goes beyond pure mic modeling, and many of its capabilities have never been possible with previous mic modeling technologies:

- **Three-dimensional Modeling** - Accurately models a wide range of mics, including complex 3D polar response, transient response, and proximity effect.
- **Re-Mic Recorded Tracks** - Select mic type, polar pattern, and all other DSP settings even after tracking.
- **Adjustable Proximity Effect** - Lets you leave a mic in place while adjusting the bass response due to proximity effect.
- **Simultaneous Mic Models** - Lets you mix multiple virtual mic models from the same physical mic before or after tracking (phase coherent).
- **Stereo** - Lets you make coincident stereo recordings with one Sphere L22 mic, and even use different mic models on the left and right channels.
- **Off-Axis Correction** - Creates more accurate polar patterns that can be used to reduce bleed, room coloration, and feedback even after tracking.
- **Axis Shift** - Virtually rotates the axis of the mic to obtain a more off-axis sound even after tracking.
- **Low-Latency DSP Processing** - The UAD plug-in version on a Universal Audio Apollo achieves extremely low latency processing (~1.6 ms round trip at 96 kHz) with guaranteed real-time performance.
- **Wide Range of Plug-In Formats** - AAX Native, VST2, VST3, and UAD (Mac and Windows); Audio Units (Mac only).

- **Flat Frequency Response** - It is possible to create a virtual mic with an extremely flat response over the entire audible spectrum (20 Hz - 20 kHz), and even compensate for the proximity effect.
- **Polar Meter** - The plug-in features a unique, visually informative Polar Pattern Meter that dynamically displays the direction and level of sound arriving at the mic.
- **Low Noise** - The microphone hardware has a self-noise level of 9 dB-A SPL, which is well below most vintage microphones and compares favorably with the best modern microphones.
- **High SPL Handling** - The Sphere mic can handle more than 140 dB SPL before clipping and is very rugged. It will not be damaged by high SPLs or air blasts like some vintage mics.
- **48 V Phantom** - Uses standard 48 V phantom power.

Summary of Key Concepts

The following concepts are so important in understanding the new capabilities offered by the Sphere L22 that we are including them here in the introduction, even though they are repeated elsewhere in this user guide.

If you do not read anything else in this guide, please read this:

- Sphere L22 is a dual-output mic that requires two 3-pin XLR mic preamp inputs for mic modeling and other DSP features to function.
- Since the two preamp channels must be set to the same gain, we recommend using digitally controlled preamps, such as a Universal Audio Apollo or Apogee Quartet.
  See http://townsendlabs.com/prelist/ for a list of recommended preamps.
- All mic modeling and other advanced DSP features occur in the Townsend Labs Sphere plug-in (included).
- The Townsend Labs Sphere plug-in has a stereo input and a mono output; the Townsend Labs Sphere 180 plug-in has stereo input and output.

Chapter 2: Installation and Configuration

This section shows you how to install and configure your Sphere system:

- Establish whether your system meets the System Requirements.
- Install the Sphere plug-in software on Mac and Windows.
- Remove the Sphere plug-in software.
- Connect the Sphere microphone to your preamp.
- Instantiate the Sphere plug-in on a stereo DAW track.
- Calibrate the left and right preamp channels.

System Requirements

The following plug-in formats are supported:

- UAD
- AAX Native
- VST2
- VST3
- Audio Units (Mac only)

The following operating systems are supported:

Native (AAX, VST, and AU):

- Mac OSX 10.8.5 and above
- Windows 7 and above

Apollo Interfaces and **UAD-2 hardware** (AAX, VST, AU, and RTAS):

- See http://uaudio.com/downloads for current info.

Your computer must meet the following system requirements:

- Native (AAX, VST, and AU) installation requires 200 MB free disk space.
  See http://uaudio.com for UAD disk space requirements.
- 1024 x 768 minimum display resolution
- Internet connection to download software
- Two microphone preamplifiers with phantom power
- Compatible plug-in host application (DAW) software supporting AAX, VST2, VST3, AU, or UAD

Preamp Connection

To connect the Sphere to your preamp:

1. Connect the 5-pin side of the included breakout connector to your Sphere mic.
   This cable breaks out into two conventional 3-pin XLR cables that you will connect to the preamp.
2. Route the Sphere's white XLR output (labeled **1-Front**) to the **MIC 1** connector on the preamp.
3. Route the Sphere's red XLR output (labeled **2-Rear**) to the **MIC 2** connector on the preamp.
4. Enable Channel Linking for the pair of channels on your preamp (if applicable).
   This automatically keeps both preamp channels set to the same level when either is adjusted.
5. Disable any filters, pads, EQ, or other processing on your preamp.
6. Enable 48 V phantom power (P48) on both channels of the preamp.
   Two LEDs light inside the headbasket to indicate that phantom power is applied to both mic channels.



Figure 2-1 Connecting Sphere mic to the preamp

If your mic preamp has digital gain control (e.g., Avid Omni or Universal Audio Apollo), you can easily calibrate each channel to the same precise level. We recommend enabling stereo linking for the preamp channels so the gain for both channels can be adjusted simultaneously.

If your preamp does *not* have digital gain control or precision analog stepped gain adjustment, proceed to *Preamp Calibration* on page 13.

Plug-in Instantiation

Instantiation in a DAW

To instantiate the Sphere plug-in on a DAW track:

1. Create a stereo track in your DAW.
2. Assign your preamp's output channels to the stereo track's inputs.
3. Select the **Townsend Labs Sphere** plug-in as a track insert.

   To use the UAD version, select **UAD Townsend Labs Sphere**.

   The left and right channels correspond to the front and rear capsules, respectively. When speaking into the front capsule and monitoring the track, you should hear (and see on the meter) significantly more level from the left channel. If that is not the case, swap the inputs on the mic preamp.



Figure 2-2 Sphere plug-in screen

The Sphere plug-in is selected from different categories for each DAW, and may vary depending on user-selected DAW preferences. These are typical DAW locations:

- **Pro Tools AAX**: Soundfield or Townsend Labs
- **Pro Tools UAD**: Soundfield or Universal Audio
- **Cubase VST3**: Spatial + Panner
- **Logic Pro AU**: Audio Units/Townsend Labs
- **Logic Pro UAD**: Audio Units/Universal Audio

Instantiation in the Apollo Console

If you connected Sphere to a Universal Audio Apollo recording interface, use the Console application for monitor and record with Sphere.

To instantiate the Sphere plug-in in the Apollo Console:

1. Open Console, locate the channel pair connected to the Sphere mic, and confirm that the channels are linked and 48 V phantom power is enabled.
2. Select the Townsend Labs Sphere plug-in as the first channel insert (see Figure 2-3 left).

   Console allows you to choose whether to monitor or record the Sphere plug-in output.



Figure 2-3 Apollo strip with Sphere as first channel insert, 48V active (left); **UAD REC** button active (right)

3. Click the **UAD REC** button to commit the selected microphone settings to disk *during* recording (see Figure 2-3 right).

   - Or -

4. Click the **UAD MON** button if you plan to insert the Sphere plug-in in your DAW later.

   This lets you change microphone settings after recording.

Although we generally recommend placing the Sphere plug-in first in the effects signal chain, good results can be achieved with the Unison plug-in in a Unison insert slot ahead of Sphere. You must apply identical settings to both channels and avoid overloading the preamp modeling. On the other hand, to use a preamp modeling plug-in to add obvious saturation, we recommend moving the preamp plug-in out of the Unison insert and placing it after the Sphere plug-in. See *DAW Signal Chain* on page 26 for details.

Preamp Calibration

This section shows how to calibrate an analog preamp with continuous gain adjustment. If your preamp has stepped gain control, you may skip this section as there is no need to calibrate your Sphere system.

Attenuation Switch

Before calibrating the preamp, you should determine if engaging the pad switch is necessary. The attenuation switch on the Sphere mic increases the available headroom so the mic can handle higher SPLs without clipping or distortion. The attenuation switch should typically be set to 0 dB for most sources, which can handle SPLs in excess of 120 dB. With the switch set to -10 dB, the mic can handle more than 130 dB SPL, and up to 140 dB SPL with the -20 dB setting. The attenuation switch is normally activated when close miking a loud source, such as a guitar amp or drum kit.

Analog Preamp with Continuous Gain Adjustment

To calibrate the input channels on an analog mic preamp with continuous gain adjustment:

1. Connect the microphone to the preamp as previously described and enable phantom power.
2. Place the mic with the front pointing at your sound source.
3. Create a stereo track in your DAW, and assign your preamp's output channels as its inputs.

   The **1-Front** and **2-Rear** channels correspond to the front and rear capsules, respectively. When speaking into the front capsule and monitoring that track, you should hear significantly more level on the **MIC 1** channel. If that is not the case, swap the inputs on the mic preamp.
4. Set the preamp's **MIC 1** channel gain to an appropriate level for your intended sound source.
5. Set the **CAL/ON** switch to the **CAL** position (see Figure 2-4) on the mic.

   The LEDs flash slowly in calibration mode, and the mic now outputs the same signal on both channels.



Figure 2-4 Sphere mic with CAL/ON switch

6. Click the gear icon under **Setup** on the lower-left corner of the plug-in (see Figure 2-2).
7. Set the gain of the **MIC 2** channel to match the gain of **MIC 1** using the Level Calibration Meter.

   If it is not possible to match the levels within 0.1 dB, press the **Auto Cal** button on the Setup page to better match the levels.
8. When finished, set the **CAL/ON** switch to the **ON** position on the mic.

   The LEDs light solid to indicate it is configured for normal use.

Hardware

Mono/stereo Usage

To record a source in mono, point the front of the microphone (denoted by the bullseye icon and the Townsend Labs logo) at the desired sound source.

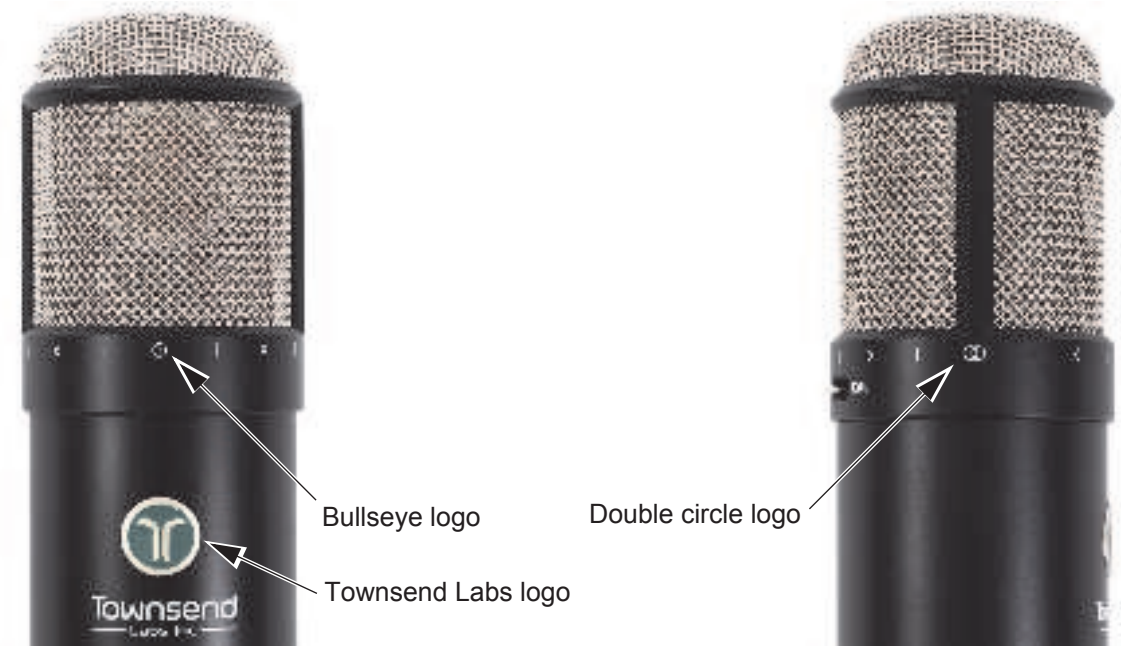


Figure 2-5 Sphere mic front (left); Sphere mic side (right)

To record a source in stereo, orient the microphone so the double circle icon points towards the sound source.

Shockmount

To help produce the flattest, most neutral response, the frequency response of the Sphere microphone extends below 20 Hz. This makes the microphone sensitive to low-frequency interference, such as floor vibration. When possible, we recommend using the supplied elastic suspension shockmount to mitigate unwanted low-frequency pickup.

Storage

When the mic will not be used for a prolonged period, it is important to store it in the supplied dust cover and case. Do not store or use in conditions of extreme temperature and/or humidity.

Phantom Power

The Sphere mic requires 48 V phantom power (P48) in accordance with the IEC 61938 specification. Do not use with any other types of phantom power.

Chapter 3: Townsend Labs Sphere Plug-ins

The Townsend Labs Sphere plug-ins are a key part of the Sphere microphone system. The Sphere microphone system can record in stereo or mono. Use the **Townsend Labs Sphere** plug-in for mono recording and the **Townsend Labs Sphere 180** plug-in for stereo. The **Townsend Labs Sphere** (with **DUAL** mode enabled only) and **Townsend Labs Sphere 180** plug-ins both contain two mic models that can be blended together as if recording with two mics. The **Townsend Labs Sphere 180** plug-in outputs each mic model on a separate channel, which lets you create stereo recordings.

MIC 1 and **MIC 2** each have their own mic model (labeled **MIC L** and **MIC R** in the Sphere 180 stereo plug-in), **PATTERN**, **FILTER**, **AXIS**, and **SOLO** controls. The other controls apply to both mics. Each control is discussed in detail below.



Figure 3-1 Sphere 180 plug-in screen



Figure 3-2 Sphere plug-in screen

Microphone Type

The **Townsend Labs Sphere 180** plug-in shows the names and images of two microphone types: **MIC L** and **MIC R** (see Figure 3-1).

The **Townsend Labs Sphere** plug-in shows the name and image of one microphone type unless in **DUAL MODE**, which shows two types: **MIC 1** and **MIC 2**.

NOTE: *The automation control list displays the mic type of each microphone as **MIC1 TYPE** and **MIC2 TYPE**.*

To select a different microphone type, do any of the following:

- Click on the *mic name* and choose a new mic from the list.
- Click on the *mic image* to display the *next* mic type.
- Right-click or ctrl-click on the *mic image* to display the *previous* mic type.
- After clicking on the mic *image* or *type*, the application focus is on the **MIC1 TYPE** (or **MIC2 TYPE**) control. Use the down/up arrows to display the next/previous mic types, respectively.
- Hover the cursor over the *mic name*, and spin the mouse scroll wheel to view the mic types

Pattern

This parameter lets you adjust the pick-up pattern of the mic model. This is equivalent to choosing a different polar pattern setting on a multi-pattern mic, but with the additional advantage of being able to select intermediate polar patterns that the original mic did not have. For example, when modeling a mic that natively supports omni, cardioid and figure-eight settings, the Sphere can synthesize transitional polar patterns, such as sub- or hypercardioid. Each mic's original patterns are highlighted in green. For microphones with a single pattern, the pattern control is fixed to that pattern.

NOTE: *The automation control list displays the* ***PATTERN*** *setting for each microphone as* ***MIC1 PATTERN*** *and* ***MIC2 PATTERN.***

Available patterns are:

- Omni
- Sub-Omni
- Wide-Cardioid
- Subcardioid
- Cardioid
- Supercardioid
- Hypercardioid
- Sub-8
- Figure-8

Filter

This parameter lets you adjust the mic model's filter type. Each mic model has three filter types, even if the original microphone has fewer or no filter options. The filter types vary according to those supplied with the original mic. Each mic's original filter type is highlighted in green. The **OFF** setting disengages the filter.

Microphones typically include a high-pass filter to reduce unwanted low-frequency rumble or proximity effect. On some models, a pad setting is included among the available filters because the pad has a characteristic sound that is also part of our modeling. Neither the mic sensitivity nor output level is affected by the pad.

NOTE: *The automation control list displays the* ***FILTER*** *settings for each microphone as* ***MIC1 FILTER*** *and* ***MIC2 FILTER.***

Axis

This parameter lets you adjust the tonality of the mic by virtually moving the source off-axis. For example, setting **AXIS** to **45º** means the *on-axis* frequency response now matches the frequency response of the mic being modeled as if it was turned 45º.

NOTE: *The automation control list displays the **AXIS** setting for each microphone as **MIC1 AXIS SHIFT** and **MIC2 AXIS SHIFT.***

It is essential to differentiate **AXIS** from physically rotating the mic, which shifts both the polar *and* frequency responses. Audio engineers often rotate a mic to obtain a different sound. Typically, most mics become darker as they move off-axis relative to the source. However, it is often more useful to keep the polar pattern constant while shifting just the tonality of the mic. **AXIS** is one of the Sphere controls that let you create *hybrid* mics that do not exist in reality.

NOTE: *Setting **AXIS** above 45º often produces undesirable results, as might occur when orienting a physical microphone too far off-axis.*

Proximity Effect

Proximity

The bass response of all directional mics increases as the source gets closer to the mic. This is commonly referred to as the *proximity effect,* and occurs because the mic's figure-8 low-frequency polar response pattern increases as the distance to the source decreases. The **PROXIMITY** control sets the amount of figure-8 response at low frequencies.

NOTE: *This control has no effect for purely omni-directional microphones.*

Prox EQ

PROX EQ lets you cut or boost within the proximity effect's low frequency range. At **0**, **PROX EQ** has no effect.

NOTE: *Unlike **PROXIMITY**, **PROX EQ** is active even with omni-directional mic models.*

Align (Sphere plug-in only)

NOTE: *This parameter is labeled **STEREO WIDTH** in the Sphere 180 plug-in.*

The plug-in's two mic models are perfectly phase aligned by default. With physical mics, this occurs when each diaphragm is the same distance from the source; this corresponds to setting **ALIGN** to **0**. **ALIGN** lets you adjust the relative distance between them.

For example, setting **ALIGN** to:

- 1 adjusts the relative phase as if **MIC 2** is 1 cm *farther* from the source than **MIC 1**.
- -1 adjusts the relative phase as if **MIC 2** is 1 cm *closer* to the source than **MIC 1**.

NOTE: *Since **ALIGN** adjusts the relative phase between mic models, it has no effect unless two mics are used.*

Stereo Width (Sphere 180 plug-in only)

NOTE: *This parameter is labeled **ALIGN** in the Sphere plug-in.*

This parameter lets you adjust the stereo width.

- **100%**: Preserves the original stereo width of the selected mic models.
- **0%**: Reduces the width to mono.
- **200%:** Increases the width beyond that of the selected mic models.

Mix (Sphere plug-in only)

NOTE: *This parameter is labeled **PAN** in the Sphere 180 plug-in.*

This parameter lets you set the relative mix of **MIC 1** and **MIC 2**.

Pan (Sphere 180 plug-in only)

NOTE: *This parameter is labeled **MIX** in the Sphere plug-in.*

This parameter lets you set the pan between **MIC L** and **MIC R.**

Off-Axis Correction

All mics have an inconsistent polar response across frequency. For example, even high-quality, large-diaphragm, cardioid, condenser mics are only accurately cardioid in a limited frequency range, such as 1 – 2 kHz; they deviate to omni and figure-8 at lower and higher frequencies, respectively. **OFF-AXIS CORRECTION** is a unique DSP process that renders a more consistent off-axis response across frequency.

While a frequency-dependent polar response is part of what gives each mic its special character, it can have considerable disadvantages, such as increased bleed, coloration of the room response, and susceptibility to feedback. **OFF-AXIS CORRECTION** can reduce all of these problems, sometimes dramatically, while still maintaining the on-axis frequency response characteristics. The direct sound is not affected.

TIP: *You can apply a different polar pattern to an existing mic. For example, replace the figure-8 pattern of a 4038 Ribbon with a cardioid to create a mic that does not exist in the real world.*

Off-Axis Correction Enable

This parameter activates the **OFF-AXIS CORRECTION** feature. Click to toggle between **IN** and **OUT**.

Off-Axis Correction Pattern

This parameter lets the user select a more idealized pattern that may suit the application better than the mic model's original pattern. When enabled, this overrides the off-axis patterns for **MIC 1** and **MIC 2**.

There are nine settings that range from omni (fully counter-clockwise) to figure 8 (fully clockwise). The figure below shows the pattern names as the control is adjusted.

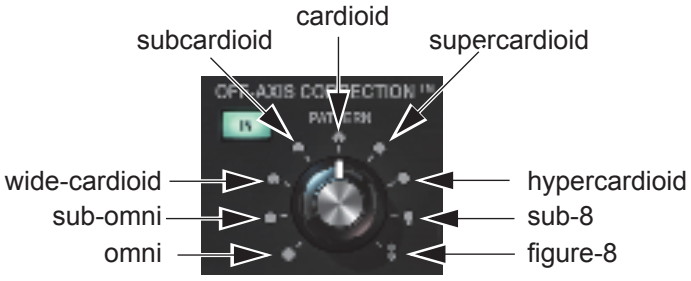


Figure 3-3 OFF-AXIS CORRECTION pattern values

On- and Off-Axis Distance

Due to the proximity effect, directional mics achieve their stipulated polar pattern for low frequencies at a single distance. This can result in substantial coloration of the mic's off-axis response.

- **ON DIST** is the distance to the source being recorded.
- **OFF DIST** is the approximate distance to background sound sources you wish to minimize, such as instrument bleed or room reflections.

Each parameter's range is 1 cm to infinity.

On- and Off-Axis Distance Auto

When set to **AUTO**, the **ON DIST** and **OFF DIST** controls are disabled from manual control but automatically correct the low frequency response. However, this tends to yield a less than ideal polar response, so usually we recommend setting it to **OFF**.

TIP: ***AUTO*** *can work well when the source is moving, or there are multiple sources at different distances.*

Output

Output Level

This lets you cut/boost the master output level up to 12 dB.

Output Phase

This lets you reverse the phase of the output, which can be useful when using multiple mics with different wiring polarities or time alignments.

Reverse

This parameter lets you switch the mic outputs so it points backwards. When using the Sphere 180 plug-in, this control swaps the left and right outputs.

Import

Click the arrow icon under **IMPORT** to import a Sphere preset. This allows users to share Sphere presets between different DAWs.

Input/Output Meter

Click the meter to toggle between displaying the input and the output levels.

Polar Meter

The Polar Meter™ displays the approximate amplitude and direction of sound arriving to the mic. The Polar Meter can be particularly useful to determine where bleed from other instruments is coming from. The moving yellow line in the Polar Meter shows the approximate amplitude and direction of arriving sound. The green line shows the polar pattern of the currently selected microphone.

The Polar Meter in Figure 3-4 shows a sound source 135° off-axis, which in most cases would be considered bleed. The user would create a polar pattern to reject as much of this unwanted sound as possible. The two "shadowed pie wedges" show where the polar pattern has the most rejection. Assuming the desired (on-axis) sound source is muted, the off-axis bleed can be minimized by lining up the area of most rejection to cover as much of the yellow shape as possible.



Figure 3-4 Polar Meter showing source at 135° off-axis

The Polar Meter cannot differentiate between sound coming from the left, right, up, or down. In this example, sound coming from 135° to the right is displayed as coming from both 135° to left and 135° to the right. This interpolation is accurate because most microphones, including the Sphere, are bilaterally symmetric. The polar pattern is the same whether off-axis to the left or right, so there is no way to adjust the pattern to reject sound on just the left or right. In general, we recommend using the Polar Meter as a guideline, and then dialing in the exact pattern by ear that produces the most rejection.

There are some inherent inaccuracies in the Polar Meter due to the mic's proximity effect, and low frequency content can distort its response. If the distance to the source is known, this can be compensated by enabling **OFF-AXIS CORRECTION** and using the distance controls to produce a more accurate Polar Meter response.

Highly reverberant environments produce a more circular Polar Meter response (see Figure 3-5) showing that sound is arriving from all directions.

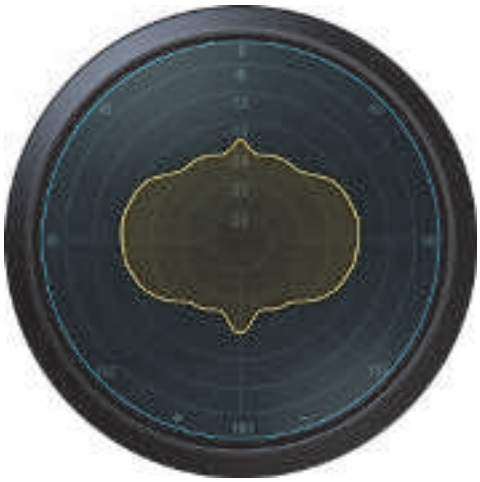


Figure 3-5 Polar Meter showing a reverberant environment

The mono Sphere plug-in shows the combined polar response of Mics 1 and 2. For example:

- If the **MIX** control is set to 50%, the response will be an equal combination of Mics 1 and 2.
- At 0% the response is fully Mic 1.
- At 100% the response is fully Mic 2.

NOTE: *If* **OFF-AXIS CORRECTION** *is enabled, that overrides the selected mic model's patterns.*

Polar Meter Zoom

Click on the +/- text to zoom the polar meter display in or out.

Link

When active, **LINK** uses **MIC 1**'s settings for **MIC 2**.

Setup

Click the gear icon under **SETUP** to access **REAR TRIM**, **SWAP**, **AUTO CAL**, and other calibration settings.

Rear Trim

REAR TRIM adjusts the input level of the rear capsule in case the preamp levels are not calibrated precisely.

Swap

This parameter lets you flip the right and left input channels. If the mic outputs were connected backwards, this corrects the wiring without repatching.

Auto Cal

This lets you automatically calibrate the input levels. This is achieved by adjusting the rear trim control to compensate for gain differences between the front and rear channels. When using Auto Cal, you must input the same signal to both the front and back mic preamp channels, which is accomplished by enabling the **CAL** switch on the Sphere mic body. See *Preamp Calibration* on page 13 for more information.

Keyboard and Mouse Shortcuts

The following shortcuts can make using the Sphere plug-ins more efficient.

- Double-click a parameter to reset its default value.

Mac

- **Option + click** a parameter to reset to its default value.
- **Command + drag** a control for finer adjustment.

Windows

- **Alt + click** a parameter to reset to its default value.
- **Ctrl + Drag** a control for finer adjustment.

Chapter 4: Using the Sphere L22 System

In many ways using a Sphere microphone is like using any conventional microphone. However, Sphere offers advanced features that are not possible with any other mic which require understanding a few new concepts and techniques. This section presents these basic concepts so you can quickly get started using your Sphere microphone system.

DAW Signal Chain

Figure 4-1 shows the correct signal flow using the mono Sphere plug-in. In most cases we recommend routing the outputs from the Sphere L22 mic directly to the Sphere plug-in without any intermediate processing, such as EQ, compression or panning. Generally, additional signal processing, including other plug-ins or analog outboard gear, should occur after the Sphere plug-in.

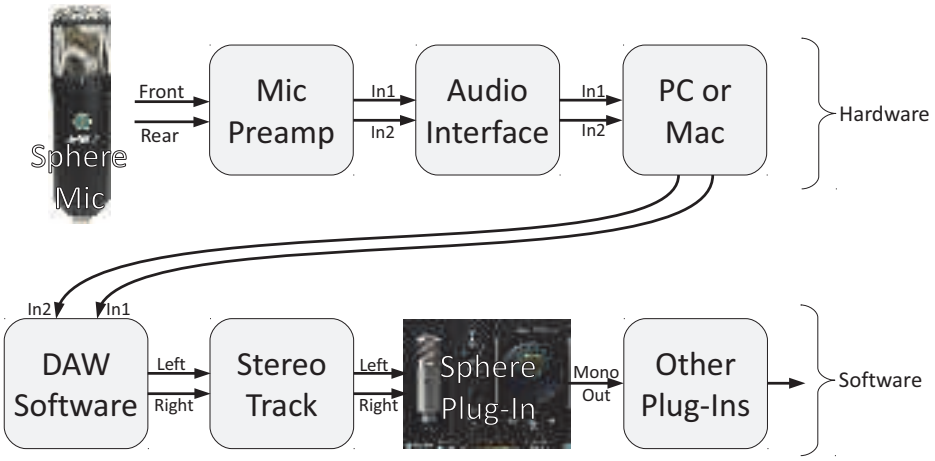


Figure 4-1 Sphere signal chain with mono output plug-in

The **Townsend Labs Sphere** plug-in outputs in mono just like a conventional mic. However, the **Townsend Labs Sphere 180** plug-in routes the left and right mic models to the left and right outputs, respectively.

Make sure to satisfy the following conditions:

- Both mic preamp channels must be set to the same gain, and this must be maintained all the way to the input of the Sphere plug-in.

  We recommend enabling gain linking for both channels (if your preamp supports it) to conveniently maintain equal gain between them.

- Route the front and rear mic outputs to the left and right inputs of the plug-in, respectively.
- Although we generally recommend placing the Sphere plug-in first in the effects signal chain, it is possible to place effects ahead of Sphere if they apply identical processing to both channels and do not impose obvious distortion or other significant non-linearities.

Preamps

Although a Sphere microphone can work with virtually any two-channel mic preamp with 3-pin XLR inputs and 48 V phantom power (P48), we recommend preamps with precision digital gain control or analog stepped gain adjustment so the channel levels can be easily matched.

NOTE: *Digitally controlled preamps may also be referred to as "recallable" or "remoteable."*

Preamps with digitally controlled gain include those found in Universal Audio's Apollo series interfaces (except Apollo 16), the Presonus Studio 192, and other products from companies including Apogee, RME, MOTU, Avid, Roland, and Focusrite. Digitally controlled preamps have the additional advantage of linking channels so their levels move together when one of them is adjusted.

Many preamps with analog stepped gain adjustment, such as the Neve 1073, work well with Sphere. Since the mic modeling assumes some of the character of the preamp used, great results can be obtained from devices with more vintage color. However, for best results, set your preamp gain to avoid clipping and disable all of the preamp's filters, pads, phase switches, and EQ.

Some analog stepped gain preamps also have a continuous fine adjustment knob, which must be set properly. Usually the maximum or middle position works best to easily match levels between channels. We recommend running a calibration procedure with the Sphere mic, especially if the preamp has a fine adjust knob, to verify that the levels are properly matched.

NOTE: *To help determine which preamp to use, we compiled an extensive list of over 250 mic preamps that have precision stepped gain adjustment. See http://townsendlabs.com/prelist.*

We recommend a preamp with a 2000-ohm (or higher) input impedance, although the mic is designed to work down to about 1000 ohms. If the preamp has variable impedance, we recommend setting it to the highest value because that generally best matches the gain between channels.

The preamp must have 48 V phantom power in accordance with the IEC 61938 specification and be able to deliver up to 8 mA of current per channel. The mic draws about 8 mA at maximum sound pressure level and about 5 mA at more typical levels.

Preamps with Continuous Gain

It is also possible to use Sphere with preamps that have continuously adjustable gain, such as those from API, Midas or SSL, although it is necessary to recalibrate the gain to match levels each time the gain is adjusted. To learn how to calibrate your preamp, see *Preamp Calibration* on page 13.

Preamp Modeling

If you use a software preamp modeling plug-in, such as those from Waves or Universal Audio (when used without Unison hardware), we typically recommend placing it directly after the Sphere plug-in to match the virtual signal chain with the corresponding physical signal chain. In this case, it usually makes sense to use a clean, transparent hardware preamp, so preamp coloration is only applied once. However, if you like the sound created by combining the colorations of hardware and software preamps, feel free to use it that way.

There are many mic preamps which are clean and transparent enough to use with Sphere. Some of these include:

- Universal Audio Apollo series interfaces (with Unison disabled and excluding Apollo 16)
- Apogee interfaces, such as the Quartet, Ensemble, and Symphony
- MOTU interfaces, such as the 4pre, 1248 and 8M
- RME interfaces, such as the Fireface UFX and Babyface
- Presonus interfaces, such as the Studio 192 and Digimax DP88
- Roland interfaces, such as the Quad-Capture and Octa-Capture
- Avid PRE and HD Omni
- Focusrite interfaces, such as the Forte and Red 4Pre (with **Air** mode disabled)
- Antelope Audio interfaces, such as the Zen Studio and Orion Studio
- Prism interfaces, such as the Atlas and Titan

Unison Preamp Modeling

Although we generally recommend placing the Sphere plug-in first in the effects signal chain, good results can be achieved with the Unison plug-in placed ahead of Sphere in a Unison insert slot, as long as exactly the same settings are applied to both channels and the preamp modeling is not overloaded.

On the other hand, to use a preamp modeling plug-in with obvious saturation, we recommend moving the preamp plug-in out of the Unison insert and placing it after the Sphere plug-in.

Single Channel Usage

A Sphere L22 microphone is actually two independent, high-quality, back-to-back, cardioid, condenser mics, but it can be used as a conventional single channel mic without DSP modeling. Each output has a cardioid pattern so you can use the microphone just like any large diaphragm cardioid condenser mic.

When only one output of the microphone has phantom power applied, only that corresponding channel is enabled. The sound quality of the front mic output is essentially equivalent to the rear output, so you can use either side. In single channel mode the mic indicator LEDs do not turn on.

NOTE: *Single channel mode should be used without the Sphere plug-in, and therefore no modeling or other DSP processing is applied.*

Monitoring Setups

There are three recommended workflows for monitoring Sphere, which include monitoring the plug-in output using your DAW, monitoring with the Apollo Console and monitoring the direct microphone output.

Live monitoring of the Sphere mic can be done in your DAW from the Sphere plug-in output. This can be preferable if you normally use your DAW (UAD, VST, AU, AAX Native) to manage monitoring, but will typically have longer processing latency than when monitoring using the Apollo Console or the direct microphone output.

Monitoring with your DAW Plug-in

You can set up monitoring in your DAW the same way as any other software monitoring configuration. See your DAW's user manual for more information about how to create monitoring paths.

To set up monitoring in your DAW:

1. Disable low-latency processing mode in your DAW (if it has that option).
2. Instantiate the Townsend Labs Sphere plug-in on an input-enabled stereo track.
3. Route the output of this stereo track to your headphone or other monitoring output stem.

Monitoring with the UAD Plug-in on Apollo

When using Universal Audio's Apollo Console application, monitoring with the UAD plug-in provides ultra-low latency processing and guarantees smooth real-time performance.

To use the Console application to set up monitoring:

1. In your DAW, disable software input monitoring.
2. In the Universal Audio Console application, click one of the mic preamp channels connected to the mic, and enable **Stereo Link** mode.

   This links the two channels into one stereo channel.
3. Instantiate the Townsend Labs Sphere plug-in on the first insert of this stereo channel.
4. Set the channel output to the appropriate monitor destination.
5. Activate **UAD MON** to just monitor UAD effects, or **UAD REC** to record *and* monitor UAD effects.

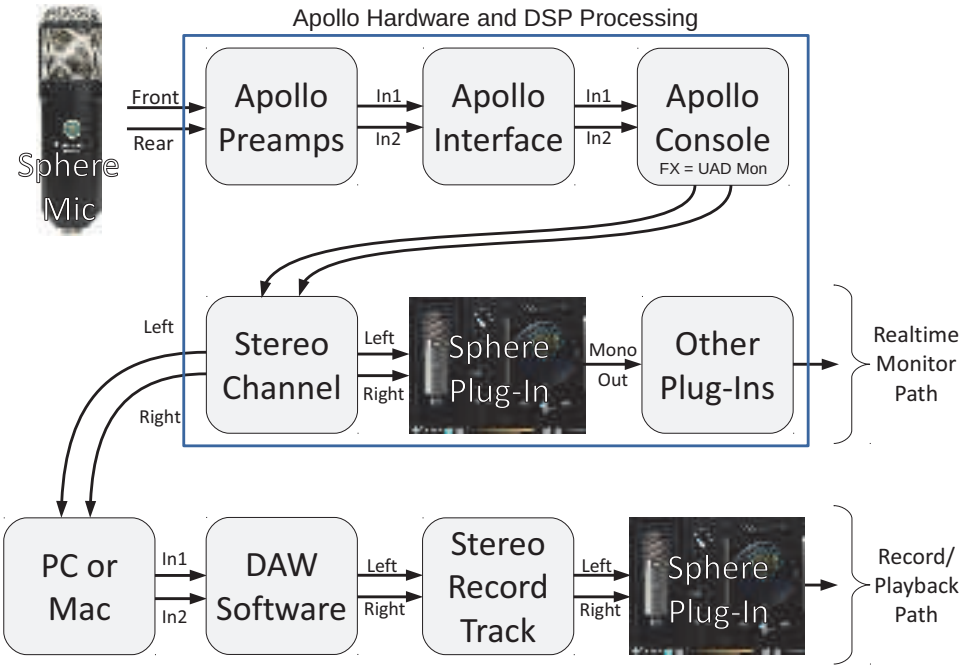


Figure 4-2 Sphere signal chain using the Apollo Console for monitoring

NOTE: *Most Apollo consoles have built mic preamps, which are ideal to use with Sphere. The Apollo 16 should use external preamps. The signal chain shown above may differ slightly in these cases.*

See the Apollo Software Manual for more information about how to create monitoring paths.

Monitoring the Direct Analog Microphone Output

To monitor the direct analog output:

1. Connect the front and rear mic outputs to your mic preamp (either standalone or as part of your audio interface).
2. Route the front output of the Sphere mic to your monitor destination.
3. Route the front and rear mic outputs to your audio interface.

   This enables recording and processing via the Sphere plug-in after tracking is completed.

Many audio interfaces include low-latency hardware mixers (e.g., Apogee, MOTU, Roland, and Presonus) that provide an easy way to create monitor outputs for Sphere.

To monitor using a low-latency mixer in an interface:

1. Set your DAW to record the Sphere mic outputs.
2. In your audio interface control panel, set up an alternate mix to route the front mic channel to your headphones or other monitor destination.

See your audio interface's user manual for more information about how to create monitoring paths.

Microphone Positioning

To get comparable results with a conventional microphone, it is essential that you properly position the Sphere mic. Even a few millimeters difference in mic position can have a significant effect on the sound.

For example, let's say you found a great setup for a Neumann U67 on a guitar amp, but do not want to risk taking your prized U67 on the road. Instead you can use the Sphere L22 and leave the U67 in the studio. However, to obtain the same sound, you must place the Sphere L22 in precisely the same position as the U67.

Because it is the position and orientation of the capsules that must be precisely aligned, not the mic bodies, this is not as simple as it seems. It is often difficult to see exactly where the capsules are located behind the grill. We recommend using a high intensity flashlight to see where the capsules are positioned.

Figure 4-3 (left) compares the Sphere L22 capsule alignment to a Neumann U67/U87. The crossed dashed lines show the center position of the capsules. As you can see, aligning the mic bodies significantly misaligns the capsules. Figure 4-3 (right) shows the capsule alignment compared to an AKG C414 XLS.

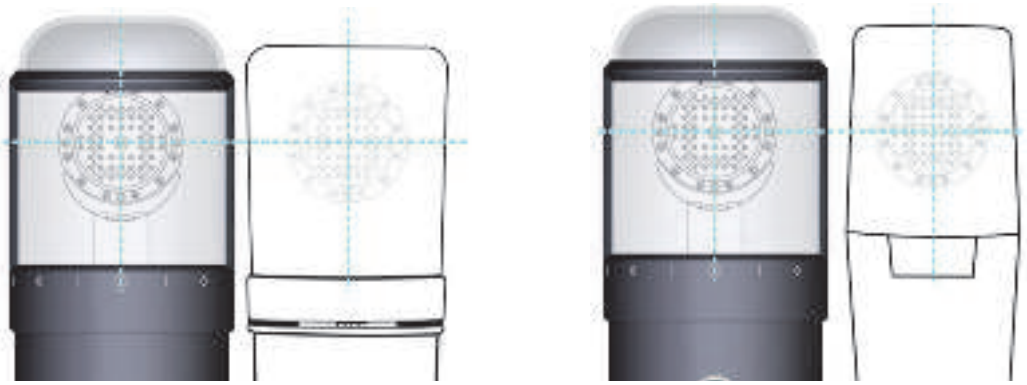


Figure 4-3 Lining up capsule centers for Sphere and Neumann U67/U87 (left) and AKG C414 (right)

It's important to remember that the capsule must be aligned in all three dimensions, as well as rotationally. Townsend Labs uses multiple self-leveling alignment lasers to ensure mic alignment. When exact positioning is the goal, we recommend using the hard-mount instead of the shock-mount, to keep the mic from moving.

Figure 4-4 shows a close-up view of the Sphere L22 from the front and side, so you can easily see where to align the microphone.

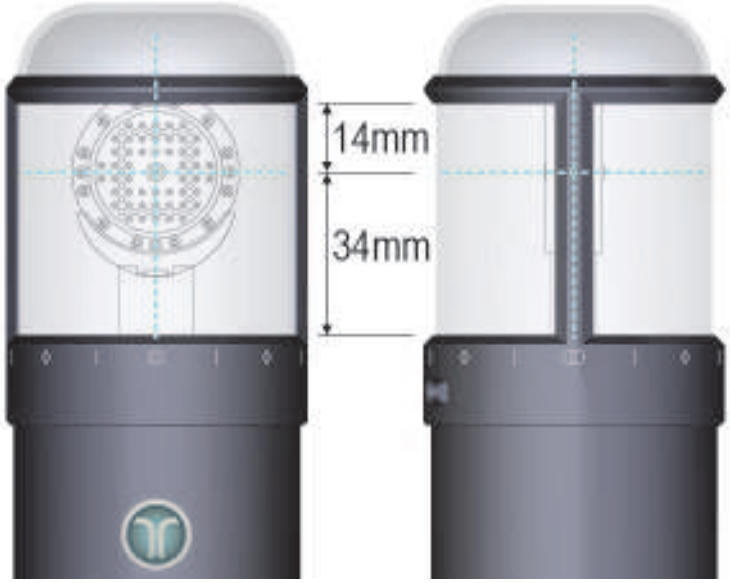


Figure 4-4 Close-up view of Sphere capsule from front (left) and side (right)

Chapter 5: Off-Axis Correction

The polar response of all mics varies across frequency. For example, a typical large-diaphragm, cardioid, condenser mic is only substantially cardioid in the 1 – 2 kHz region. It deviates to omni and figure-8 at lower and higher frequencies. Sphere's Off-Axis Correction feature improves the mic's polar response by applying DSP compensation to create a more consistent off-axis response across frequency.

While a mic's non-ideal polar response is partly responsible for its characteristic sound, it can produce considerable disadvantages, such as bleed, room coloration, and feedback. Off-Axis Correction can reduce these problems, sometimes dramatically. The correction is applied without changing the mic model's on-axis frequency response, so the direct sound is still picked up as intended.

Technical Details

This section provides a brief technical explanation of Off-Axis Correction, which can help you understand how to best use it. If you would like to skip ahead, proceed to the application chapters beginning with Chapter 6: *Recording Vocals*.

Figure 5-1 shows the published polar pattern of a Neumann U87ai in the cardioid setting at 125 Hz (blue), 1 kHz (red), and 4 kHz (green). Notice that the pattern is actually cardioid only at 1 kHz. The pattern approaches omnidirectional at 125 Hz, and is roughly hypercardioid at 4 kHz.

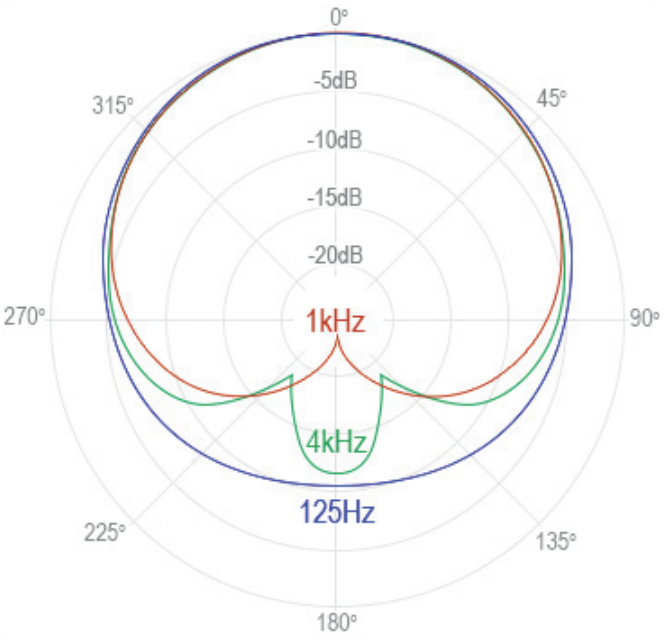


Figure 5-1 U87ai cardioid polar pattern

Figure 5-2 compares the frequency response from directly behind a U87ai mic (180° off-axis, 1 m from the source, with 1/6-octave smoothing) with a Sphere mic (same position) with Off-Axis Correction enabled. The green line shows the frequency response of a Neumann U87ai; the blue line shows the response of the Sphere mic. The Sphere polar response is much flatter: The U87 response varies by as much 16 dB, whereas the Sphere mic varies by about 6 dB with smoother overall fluctuations. Not surprisingly, the U87ai's audio from 180° off-axis sounds very colored, while the Sphere produces a smoother sound comprised mostly of natural room ambience.

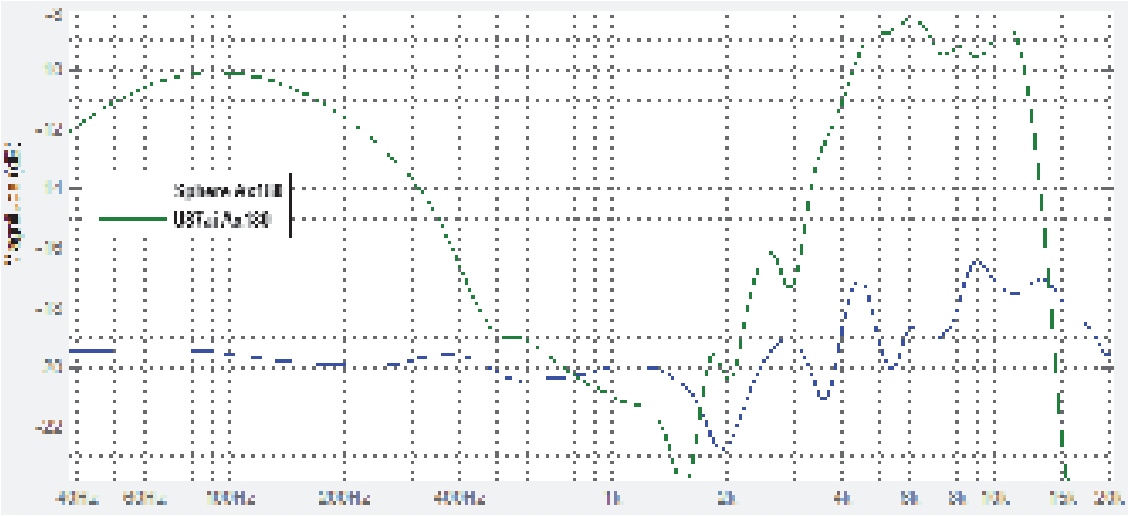


Figure 5-2 U87ai Cardioid 180° off-axis vs. Sphere Off-Axis Correction

Another potential issue is that the on-axis frequency response of virtually all multi-pattern mics also changes dramatically when adjusting the polar pattern. This can be a problem when you have the sound dialed in, but then later decide to change the pattern to reduce bleed or feedback. With Off-Axis Correction, it is now possible to adjust the polar pattern without changing on-axis frequency response.

Figure 5-3 shows the on-axis frequency response of a U87ai at its three pattern settings. At low and high frequencies, omni and figure-8 differ in response by up to 8 dB.

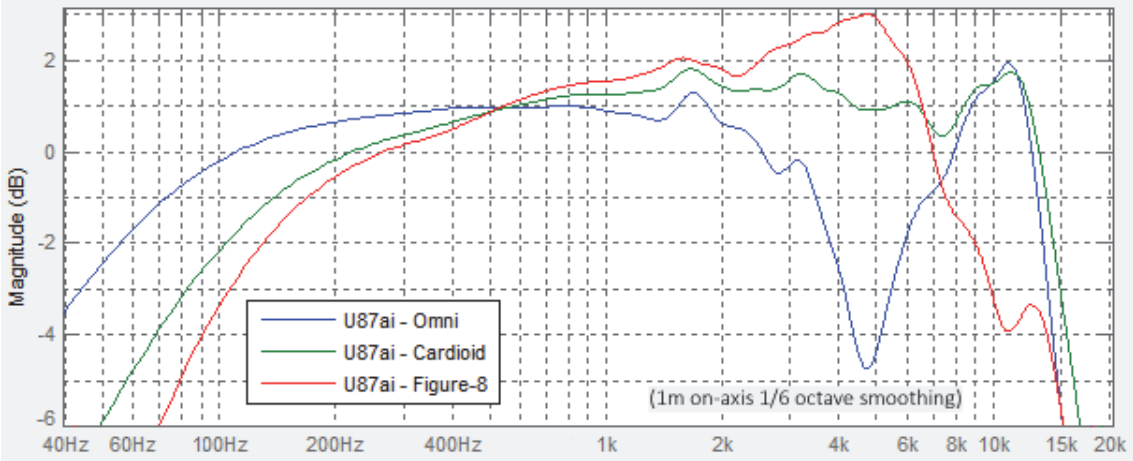


Figure 5-3 U87ai measured on-axis frequency response

You can also apply any mic frequency response to any polar pattern. For example, you can combine a 4038 ribbon response (normally figure-8) with a cardioid pattern, or take a U87 model and make it hyper-cardioid. For the ribbon this can be extremely useful when trying to deal with bleed from directly behind the mic. Making the U87 hyper-cardioid can significantly reduce room pickup.

Effectively, you have created a hybrid microphone from two different mics that did not previously exist! This enormous flexibility lets you easily obtain the precise attributes demanded by your application.

Proximity Effect

All directional microphones have polar patterns that vary with distance at frequencies below about 1 kHz. This is an inherent consequence of the proximity effect. For example, at low frequencies a typical large, dual-diaphragm, cardioid, condenser mic (e.g., U87 or 414) tends towards a figure-8 pattern close to the mic and omnidirectional farther away. Only at some distance in between will the mic have a cardioid response. This distance, typically 0.5 - 1.0 m, depends on the capsule design.

To further illustrate the differences in low frequency response, a typical small, single-diaphragm, cardioid, condenser mic tends to have a figure-8 pattern close to the mic (< 10 cm), cardioid at far distances (> 4 m), and hyper-cardioid at middle distances (1 – 4 m). However, this is a generalization that depends on the capsule design of the mic.

It is evident that the polar pattern you want might not be obtained, depending on the distance of the sound sources from the mic. For example, this can be a problem when you want to reduce kick drum mic bleed, but your cardioid mic is acting omnidirectional at those lower frequencies.

For this reason Off-Axis Correction has distance controls so you can dial in the desired polar pattern at the mic's actual distance. The **ON DIST** control sets the on-axis frequency response to match the frequency response of the modeled microphone at the selected distance. The **OFF DIST** control sets the distance at which the Off-Axis Correction Polar Pattern control is most accurate.

Setting the Controls

The Sphere plug-in's Off-Axis Correction section has four controls and an enable button (See *Off-Axis Correction* on page 21 for a complete description of its controls). When the enable button is engaged, the Pattern control in this section overrides the mic model's pattern, although the mic model pattern controls continue to affect the on-axis frequency response.



Figure 5-4 Sphere plug-in's **OFF-AXIS CORRECTION** controls

The **ON DIST** and **OFF DIST** controls specify the on- and off-axis distance, respectively, to the sound sources. Let's say you have two room mics that are 2 m from a kick drum that face directly away from the kick. You might set the polar pattern to cardioid to minimize kick drum leakage into the room mics. However, conventional cardioid mics typically have a lot of leakage, especially at low frequencies, where the pattern moves towards omni or figure-8.

By enabling Off-Axis Correction (**IN** is on) and setting the corresponding **PATTERN** control to cardioid, it is possible to have a much more accurate polar pattern. In this case, set **OFF DIST** to about 2 m. Set **ON DIST** to a larger value because most of the sound reaching the front of the mic will have traveled further after reflecting off walls, ceiling, and floor.

The distance can be estimated by calculating the path length of the first reflection, although there is usually no need to be exact. It normally works well to set the controls approximately and then dial them in by ear. The actual distance value assumes the sound originates from an infinitely small sound source. When the sound source is relatively large, you can think of the distance value as corresponding to the average distance to the source.

For example, with a mic on a guitar cab's grill, some sound is picked up from the center of the cone and some from the edges. The average distance corresponds to a point somewhere in between. There is no need to take measurements; just make an estimate and dial it in by ear. Typically, when **ON DIST** is set properly, enabling and disabling Off-Axis Correction results in a minimal change for on-axis sources. Adjust **OFF DIST** until off-axis sounds have the highest amount of rejection. If in doubt, start with these default settings: **ON DIST** = 20 cm; and **OFF DIST** = 1 m.

The **AUTO** button essentially disables Off-Axis Correction below about 1 kHz, so the response is equal to the mic being modeled. Auto mode can be useful if there are multiple sources at different distances or the sources are moving. We normally recommend leaving Auto mode off, but use the setting that sounds best. With Auto mode on, both distance controls are disabled.

Rear Miking

Sometimes it's desirable to intentionally record tracks with lots of room ambience to create a sense of depth in the mix. For example, background vocals can benefit from more room sound so they sit farther back, while the lead vocal may be easier to hear if left relatively dry.

You can achieve this result for background vocals by placing an omni mic farther back from the sources. While this can produce excellent results, some cases might require even more ambience. Moving the mic farther back might work, but recording spaces are often small, which limits the mic position. This could also yield a sound that is too reverberant, which may not be desirable.

Another option blends close mics with room mics. While this approach can often work fantastically, different arrival times at each mic may cause comb filtering due to phase cancellations between them.

A third option is to use a sub-cardioid microphone facing directly away from the sound source. This emphasizes room pickup, and because it's a single mic, there are no phase cancellations. The downside is that the rear pickup of most directional mics is heavily colored, so the direct sound might not be so great. Cardioid mics tend to have the most rear coloration. Using some flavor of sub- or wide-cardioid tends be less colored, but off-axis coloration can still be a significant problem for this type of application.

Because Off-Axis Correction produces a response with significantly less off-axis coloration, it is much more practical to use these rear miking techniques. It is not even necessary to physically reverse the microphone. In the plug-in, activate the **REV** button during or after tracking, and the polar pattern rotates 180°. Then dial in the pattern control to achieve the precise ratio of room and direct sound.

Additional Applications

There are endless uses for Sphere's Off-Axis Correction feature. Room miking can greatly benefit from this technology because you can often better isolate the reverb from the direct sound by using a cardioid pattern. You can also use Off-Axis Correction on room mics to produce a more accurate omni pattern, which often sounds more open and airy.

You can also sometimes diagnose poor acoustics by listening to the pure reverb signal. Position the mic 180° off-axis and a couple meters away from a snare drum. Hit the snare and listen for flutter echoes and other sonic artifacts. Position and point the mic in different places until you find the right location.

The following chapters contain a wealth of information about how to use Sphere to record vocals and other instruments.

Chapter 6: Recording Vocals

Getting a great vocal sound can be challenging, especially when recording in an environment without proper acoustical treatment. For this reason, a Sphere L22 microphone with Sphere technology offers numerous features to help you get the best possible sound, whether in a professional or project studio. To record a single vocalist, you should use the Sphere plug-in. You could record two vocalists at once using the Sphere 180 plug-in.

Professional Studio

In a professional studio with excellent acoustics, you can use the Sphere LS22 microphone just like a normal mic. If you have already produced a great vocal sound with a conventional mic, you can just swap in the Sphere mic and select a mic model and polar pattern.

To accurately capture the character of the original mic, Sphere technology models the mic's full polar response, including its on- and off-axis frequency responses, and proximity effect. Accurate modeling of proximity effect means the artist can *work the mic* in all the familiar ways: closer for a more intimate, warm sound, and further back for a brighter more diffuse sound. Sphere technology also offers tremendous flexibility *after* tracking, such as selecting from a wide range of mic models and polar patterns.

Proximity Effect

If a mic model does not have the desired amount of proximity effect, Sphere technology allows you to change it. The **PROXIMITY** control is not simply an EQ, but actually changes the amount of proximity effect. Using EQ can be somewhat effective, but the **PROXIMITY** control is usually an easier and better sounding option.

Since the proximity effect only occurs for directional mics, this control has no effect when an omni-directional pattern is selected. Partly for this reason, there is also a **PROXIMITY EQ** control that approximates the sound of proximity effect by using carefully tailored equalization at the output of the plug-in.

Axis

Sometimes recording engineers position a mic a bit off-axis to modify a vocal sound that is too sibilant or bright. This works because mic capsules are typically less sensitive to high frequencies entering from the side.

The **AXIS** control lets the user model this effect without rotating the mic or shifting its polar pattern. For example, with **AXIS** set to 45°, the frequency response of the modeled mic at 45° is used as its on-axis response.

The Room

Even a studio with good acoustics may not be ideal for your application. It could be too reverberant, dry, or contain unflattering bass resonances. Repositioning the mic and/or artist is generally the best solution, but that isn't practical if the track has already been recorded. With Sphere you can continuously alter the polar pattern of the mic to blend in the desired amount of room sound after the track has been recorded!

Home and Project Studios

Less than ideal recording environments, such as a typical home or project studio, often have too much (or poor quality) room ambience and reverberation that often produce flutter echoes and comb filtering. Sphere offers great features to help achieve a professional vocal sound despite these impediments. While it is always a good idea to optimize these issues acoustically, it is often not practical. Acoustical treatments for a home studio can be costly, and might not appeal aesthetically to the other family members who use the space.

Off-Axis Correction

Sphere's **OFF-AXIS CORRECTION™** can minimize room reflections and produce a more present, intimate sound. **OFF-AXIS CORRECTION** works by applying a correction factor to the mic's polar response to yield a more accurate pattern.

For example, the polar patterns for virtually all conventional cardioid mics vary substantially with frequency. A typical large diaphragm condenser mic might be cardioid in the range 1 – 2 kHz, omnidirectional below 150 Hz, and figure-8 (or other non-cardioid patterns) at higher frequencies. These variations from an accurate cardioid response are important factors that characterize the sound of each mic, and even the best have some of these imperfect properties. However, when acoustics are not ideal or other instruments bleed into the coverage of the mic, they can cause problems.

With **OFF-AXIS CORRECTION** enabled, a mic's flawed cardioid pattern, like the one described above, can be converted into a more accurate cardioid pattern across its full audible spectrum. This can lead to more off-axis rejection and therefore a less colored off-axis response. But perhaps most importantly, **OFF-AXIS CORRECTION** lets you set the mic model, and consequently its on-axis response and entire polar pattern independently. This means you can take any mic model, such as a cardioid 87, and apply a different pattern, such as hypercardioid, that is not necessarily found in the original mic, yet still maintain the overall sonic character.

Assuming room reflections arrive at the mic equally from all directions, a hypercardioid pattern produces the least room pickup, which can significantly reduce the effect of poor acoustics. Using a hypercardioid pattern also lets the vocalist move farther from the mic without getting too much room sound, which can produce a more natural recording.

There are many hypercardioid mics available with fixed or multi-pattern options. For example, the AKG 414 and Neumann TLM-170 large diaphragm condenser mics have a hypercardioid option, but they are not necessarily the best sounding choices. Mic designers typically optimize the cardioid setting to sound best, followed by the omnidirectional option. The change in sound between omni, cardioid, hypercardioid and figure-8 can be quite dramatic; hypercardioid and figure-8 are often not the best patterns for vocals.

The proximity effect can also increase with more directional patterns. A cardioid or subcardioid mic typically gives the best frequency balance, but that may conflict with getting a clear vocal sound provided by a more directional pattern.

With **OFF-AXIS CORRECTION**, this is no longer a restriction. For example, you can select a subcardioid LD-67 model combined with a hypercardioid pattern. This creates a hybrid mic model incorporating the best of both worlds.

Acoustic Treatment

Hypercardioid mics have a rear lobe in their reception pattern that picks up some sound from directly behind the mic, which may include some room reflections. However, this lobe is usually small enough that placing acoustical material behind the mic (i.e., a GOBO or reflection filter) can minimize it without having to treat the entire room.

OFF-AXIS CORRECTION also allows you to continuously dial in the best pattern for a particular room and application. Sometimes a pattern somewhere between hypercardioid and figure-8 is ideal.

Due to the proximity effect, the polar pattern of any directional mic varies with distance from the vocalist. The On-Axis Distance control lets you set the distance between the mic and the vocalist. The Off-Axis Distance control lets you set the distance between the mic and the sources you are trying not to pick up, such as bleed from other instruments or reflections from floors, ceilings, and walls.

Since there is unlikely to be a single off-axis source distance, an average or approximate distance works perfectly well. For example, if the distance to the walls is 2 m and the distance to the floor is 1 m, a setting of 1.5 m is a good choice; fine tuning it by ear is the best option.

Setup for Vocal Recording

To record vocals using the Sphere mic with OFF-AXIS CORRECTION enabled:

1. Setup mic as normal.
2. Select desired mic model/pattern.

   Feel free to experiment with different mic models and patterns (even after recording) once everything is setup.
3. Enable **OFF-AXIS CORRECTION** by clicking the **OUT** field so it reads **IN**.
4. Set the **PATTERN** to hypercardioid.

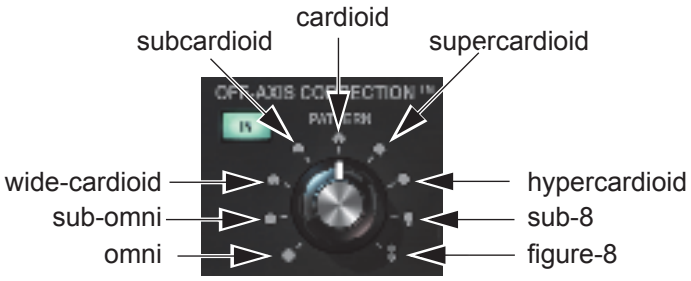


Figure 6-1 OFF-AXIS CORRECTION pattern values

5. Set the on-axis distance (**ON DIST**) to the distance between the mic and vocalist.
6. Set the off-axis distance (**OFF DIST**) to the approximate distance between the mic and the walls of the room. If in doubt, 1 m is a good choice.
7. Place a GOBO or reflection filter behind the mic to minimize rear lobe pickup.

Chapter 7: Recording Acoustic Guitar

The Sphere L22 Precision Microphone System has a number of features that let you obtain a natural, traditional acoustic guitar sound, or something more modern with a wide stereo spread. The Sphere system lets you adjust mic type and polar pattern, even after tracking, which can be extremely helpful for dialing in the right sound. Most of the techniques described here can also be applied to recording other acoustical instruments.

The pattern and off-axis settings control the amount of room sound picked up by the mic. The bass response is often exaggerated due to the proximity effect, especially when the mic is pointed near the guitar's sound hole. Angling the mic towards the neck or pulling it farther back from the guitar can solve the bass problem, but the sound will change in ways that may, or may not, be beneficial. With Sphere technology you can independently adjust the amount of proximity effect, which provides more flexibility in mic placement. The Proximity control adjusts the amount of proximity effect in a different way than just applying EQ. In fact, this control changes the polar pattern of the mic at low frequencies, simulating what would happen if the capsule was physically modified to have a different amount of proximity effect.

Even though Sphere technology lets you adjust a wide range of parameters after recording, there is no substitute for proper mic placement. Many acoustic instruments, including acoustic guitar, have complex dispersion patterns, which means that each area of the instrument can radiate very different sounds. For example, the neck area of an acoustic guitar emits a bright, crisp sound compared to the soundhole, which produces more low frequencies. You can emphasize string and fret sound by placing the mic further up the neck and/or closer to the strings.

TIP: *Put your finger in one ear and listen to the guitar at various potential mic locations until you find a spot you like, and place the mic there. If you are working alone, you can monitor the guitar with isolated headphones while playing, and then move the guitar around to find the best spot. This is easier to do if you are standing up wearing a guitar strap.*

Guitar with Vocals

Two Mics

For a guitarist who sings, it is often desirable to record the guitar and vocal at the same time to capture alive performance, instead of relying on overdubs. Typically accomplished using separate mics for the vocal and guitar, this technique can work well but you must consider bleed from the off-axis sources. The bleed will generally be out of phase with the on-axis sound, so comb-filtering will result when the two tracks are mixed together. Even if the mics are aligned well enough to prevent comb-filtering, the high frequency response will likely be compromised due to very small differences in distance. Since sound at 20 kHz has a wavelength less than 2 cm, just a difference in path length of a few millimeters can noticeably affect the high frequency response. In most cases, it is impractical to align mics with that degree of accuracy.

All of these issues are further complicated when EQ, compression, and other processing is added to the individual tracks. Equalizing the guitar track also applies that EQ to the bleed from the vocal, and vice versa. Therefore, it's often not possible to find EQ settings that work well for both the vocal and the guitar. Compression generally increases the level of the bleed relative to the primary source, which can also exacerbate phase issues.

Cardioid mics are often used in this application for their directionality, but bleed can still be a problem: at 90° off-axis, the level is only 6 dB down. Another common approach uses a mic with a figure-8 pattern, such as a ribbon or multi-pattern condenser, because the response at 90° off-axis is close to zero. This allows placing the acoustic guitar in the null of the vocal mic, while still getting good direct vocal pickup. The guitar mic is pointed directly at the guitar but oriented to reject the vocal. With proper placement, this can produce an incredible amount of isolation between the guitar and vocal, so you hear just reverb from the off-axis source, with virtually no dry signal.

Figure 7-1 shows this technique in action. The vocal mic is on top with a polar pattern shown by the blue figure-8, and the guitar mic is below with a polar pattern shown by the magenta figure-8. Each mic is positioned to reject the other's sound.



Figure 7-1 Recording acoustic guitar and vocals with two mics

One potential problem is that figure-8 mics tend to have certain sonic qualities, such as significant proximity effect, that can be great for some applications but less than ideal for others. The **OFF-AXIS CORRECTION** feature solves this problem by letting you independently select the polar pattern from the mic type. For example, to get the sound of a 47 microphone set to cardioid but with the isolation of a figure-8 pattern:

1. Select LD-47 as the mic type with a cardioid pattern.
2. Set the **OFF-AXIS CORRECTION** pattern control to figure-8.

The goal is not to create an equivalent mic, but rather a hybrid specifically optimized for the current application.

One Mic

If you don't have two Sphere mics, you can still approximate the two-mic setup by using the front side for vocals and the rear side for guitar (see Figure 7-2).

1. In your DAW, instantiate the Sphere 180 plug-in on a stereo track.
2. Assign the left output to the vocal and right to guitar.
3. Enable **OFF-AXIS CORRECTION** and set the pattern to cardioid to minimize the bleed from the off-axis source.

With conventional cardioid mics, the rear sound pick up is typically very colored due to physical limitations of the capsule, which can largely be avoided using **OFF-AXIS CORRECTION**.

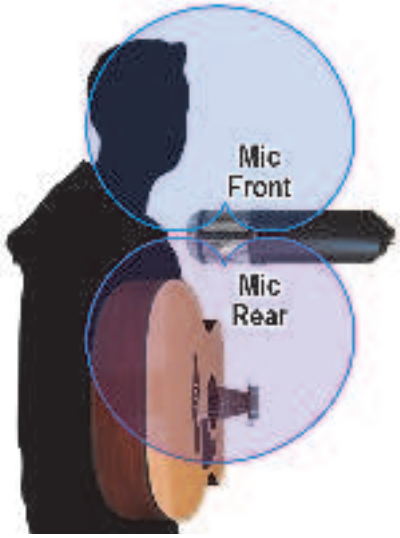


Figure 7-2 Recording acoustic guitar and vocals with one mic

Stereo Guitar

One Mic

For a rich, spacious sound it is often desirable to record acoustic guitar in stereo. A wonderful feature of the Sphere system is recording in stereo with one mic using the Townsend Labs Sphere 180 plug-in. By rotating the mic 90° off-axis, the front and back correspond to the left and right channel outputs, respectively.

One major benefit of this approach is that the two capsules are close enough to avoid the phase issues that can occur with non-coincident stereo mic placement. Although coincident mic techniques tend to produce a narrower stereo image than some others, the Sphere's back-to-back capsule configuration produces the widest stereo spread of any coincident setup, and is comparable in width to spaced pairs. We recommend using a cardioid or supercardioid pattern for both outputs, with supercardioid producing a wider stereo image.

A good starting point is to place the mic around the 12th fret of the guitar. For some guitars, this may result in too much bass from the bridge or a thin trebly sound from the neck, so move the mic between them to find the sweet spot (see Figure 7-3).

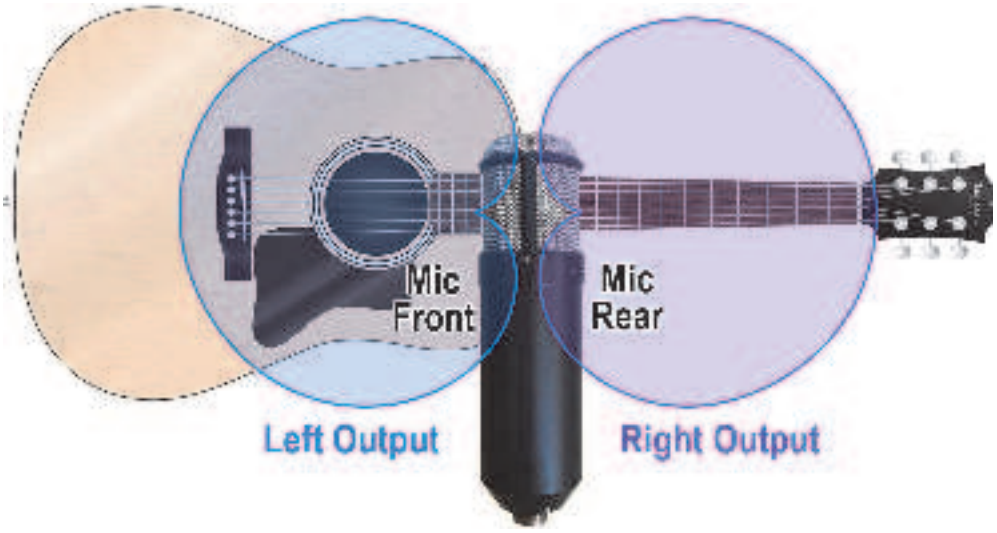


Figure 7-3 Recording acoustic guitar in stereo with one mic near neck

Another option is to line the mic up with the soundhole but at roughly the height of the guitarist's head. This can create a more balanced sound, since both capsules receive the same level from the soundhole, but without getting a direct hit. It can also give a more natural and familiar sound because the mic capsules are positioned near the guitarist's ears.

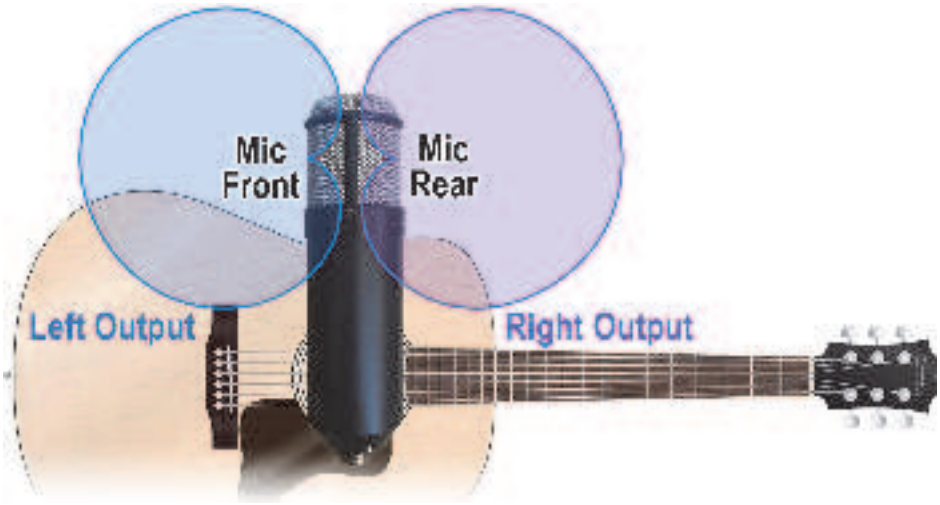


Figure 7-4 Recording acoustic guitar in stereo with one mic above guitar

But even after finding a position that you like, there can still be a large timbral imbalance between channels. With conventional mics this is sometimes handled by choosing a small condenser for the bridge that is bass light, and a ribbon for the neck that is bass heavy. The Sphere 180 plug-in lets you select different mic models for each output, so this effect can be achieved with just one physical mic!

Two Mics

With two Sphere microphones you can use any standard stereo technique (e.g., XY, spaced-pair, ORTF, mid-side, or Blumlein) but now with enhanced flexibility. The left of Figure 7-5 shows a horizontal 90° XY configuration, while the right shows the same XY configuration oriented vertically. Either option can work well, so choose the easier setup.
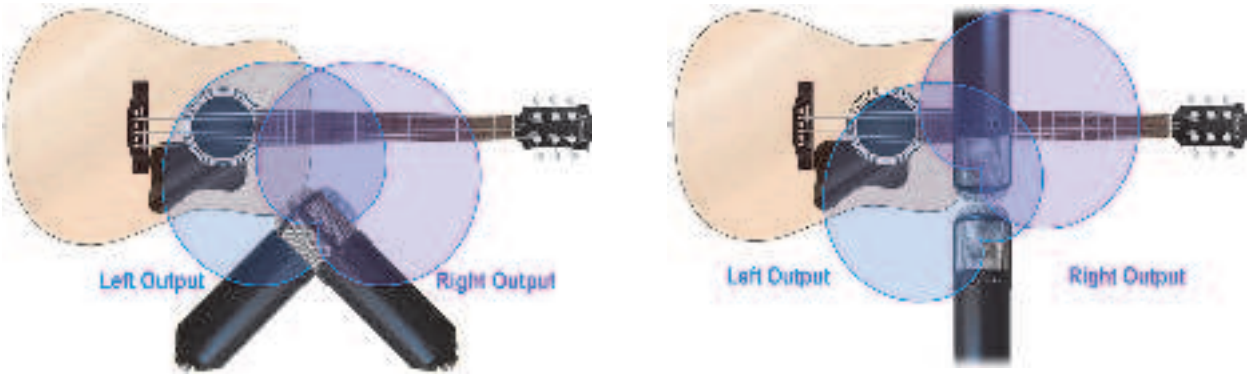


Figure 7-5 Recording acoustic guitar in stereo using XY technique: horizontal (left), vertical (right)

Because the Sphere plug-in lets you change the mic pattern as you work (even after recording), you can switch from XY to Blumlein by simply adjusting the pattern controls from cardioid to figure-8. You can also select a sub-cardioid pattern for a narrower stereo image, or hypercardioid for a wider image without picking up as much room sound from behind the mics.

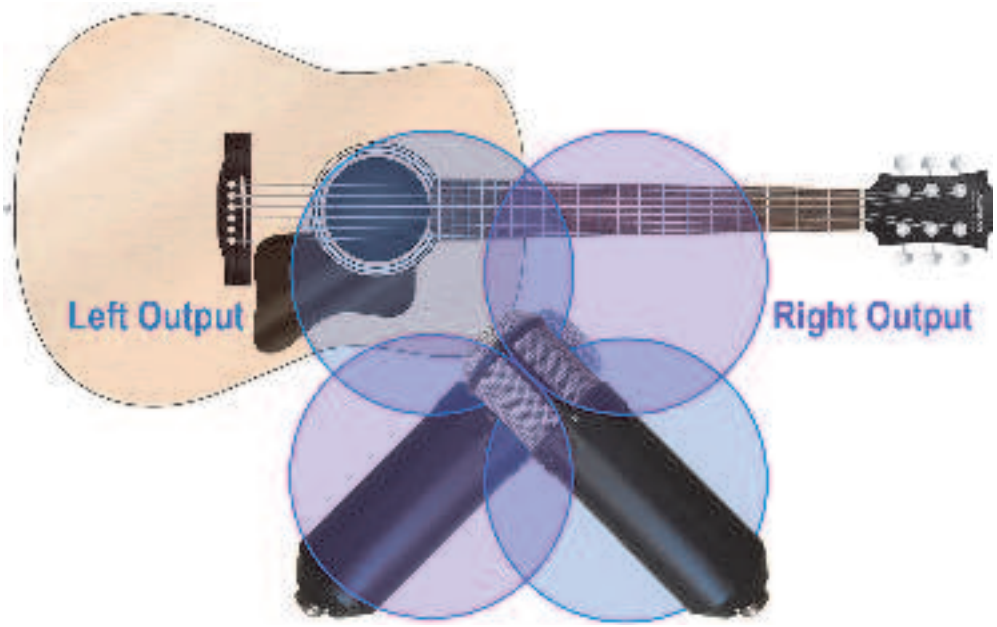


Figure 7-6 Recording acoustic guitar in stereo using Blumlein technique

Another common miking technique for acoustic guitar is the spaced-pair. Start with one mic near the bridge and the other at the neck near the 12th fret (see Figure 7-7).

A spaced-pair can produce excellent results but like any non-coincident technique, sound arrives at the mics at different times. This can result in comb filtering and mono incompatibility.

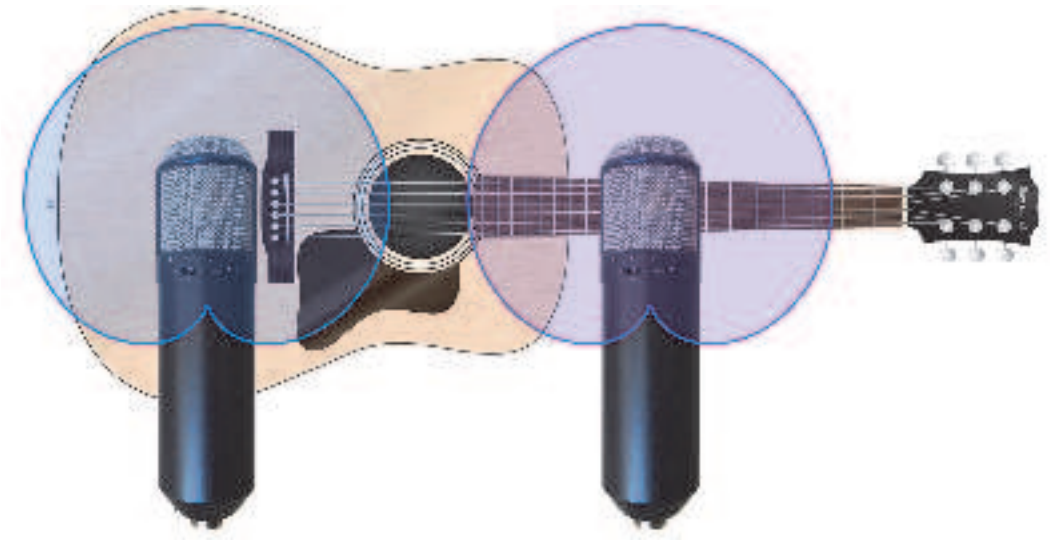


Figure 7-7 Recording acoustic guitar in stereo using spaced pair technique

To minimize phase issues, set the distance between mics to at least three times the distance from each mic to the guitar.

TIP: *To verify that phase issues have not become a problem, sum the left and right channels to mono and listen for comb filtering or other artifacts.*

This just scratches the surface of how to best record acoustic guitar with a Sphere mic. For more a more in depth look at this topic, see the following excellent Sound On Sound magazine article:

Recording Acoustic Guitar - Techniques From The World's Top Engineers & Producers

See Chapter 8: *Stereo Recording* to learn more about single and multiple mic stereo setups.

Chapter 8: Stereo Recording

The Sphere mic provides numerous options for stereo recording. Any stereo miking technique, such as XY, spaced pair, MS, and ORTF, can be used effectively with a pair of Sphere microphones, just as you would with conventional mics. But it's also possible to record in stereo with a single Sphere mic. If you're feeling adventurous, you even can record 4- or 5-channel surround with two Sphere mics.

Single Microphone

Recording stereo with a single Sphere mic is the simplest approach, but offers less flexibility than using two mics. A Sphere microphone can create two virtual mics with one pointing forward and the other pointing backward. For stereo recording, the mic is rotated 90°, so the front output becomes the left channel, and the rear output becomes the right channel. This provides a 180° (back-to-back) capsule arrangement. To use the microphone in stereo mode, you must instantiate the Sphere 180 plug-in, which provides discrete left and right outputs.

Because the left and right diaphragms are coincident, perfect phase coherency is always maintained, even when the channels are summed to mono. For a coincident mic technique, this produces the widest stereo spread possible, but will likely leave a *hole* in the center of the stereo field. This occurs because the center of the stereo field corresponds to 90° off-axis from each capsule, which is where the high frequency response is typically lowest. Nonetheless, if the goal is to produce a wide stereo spread with room in the middle for center-panned material, then this is a benefit not a detriment. The best results are usually achieved by setting the polar pattern to somewhere between cardioid and supercardioid, with supercardioid providing a wider stereo field.

NOTE: *Hypercardioid can sometimes widen the stereo field further, but it can also create phase problems, so be careful if you use that setting.*

It is also possible to have independent mic models applied to the left and right outputs. For acoustic guitar recording, pickup from the sound hole often produces an overly bassy sound, so the bridge side ends up being too boomy and the neck side is much brighter. You can compensate for this by choosing a bridge side mic model that is bass light, and a neck side model that is bass heavy.

Two Microphones

Using two mics lets you employ a wider range of stereo techniques. In general, you can use the same stereo techniques you have used before, although there are some advanced features, such as **OFF-AXIS CORRECTION™**, which open up new options.

With two Sphere mics you can even go beyond stereo to quad or 5.0 surround. A nice way to achieve this is to use an XY mic configuration, with each mic positioned coincidently 90° off-axis from the other. From this you can capture front left and rear right outputs from one mic and the front right and rear left outputs from the other mic. Cardioid patterns are typically used for all mics in this application.

To create a center channel for 5.0 surround, the simplest option is to just sum the left and right virtual mic outputs. This creates a center-panned virtual cardioid mic (assuming left and right outputs are cardioid). A potentially better option is to sum the raw unprocessed outputs of both mics and send them to a stereo bus with another Sphere plug-in. This lets the user set the center channel polar pattern independently. Setting the pattern to super- or hypercardioid will produce better separation of the center from the left and right channels. Since there are many possibilities, experiment to figure out what sounds best for your application.

Off-Axis Correction

Since cardioid mics lose directivity at low frequencies, they become omnidirectional and thus center panned in the bass region, which blurs the stereo field.

Consider a stereo recording of a double bass, where the low frequency fundamentals will be perceived more towards the center than the high frequency harmonics. Instead of occupying one point in the stereo field, this single instrument will be spread out.

This change in polar pattern also depends on distance to the source, which is due to the well known proximity effect. In fact, at low frequencies it is only possible to maintain a cardioid polar pattern at one specific distance from the source (see *Off-Axis Correction* on page 21 for more information). Because of this, the **OFF-AXIS CORRECTION** feature has two distance controls, which tell the algorithm how far away the mic is from the sources. The first control is **ON-AXIS DISTANCE**, which specifies the distance of the on-axis source material from the mic. The second control is **OFF-AXIS DISTANCE**, which specifies the distance of the off-axis source material from the mic.

Fortunately, these controls do not need to be set exactly, and can be dialed in by ear. If there are multiple sources at multiple distances, then just use an average distance, or simply go with what sounds best.

OFF-AXIS CORRECTION can also be important for mid-side and other stereo and surround configurations that use heterogeneous mic configurations. For example, with mid-side, the mid channel is either a cardioid or omni mic and the side channel is a figure-8 mic. But practically speaking, the figure-8 mics always have a different frequency response than omni and cardioid mics, so in effect the mid-side encoding will have frequency dependent errors in the response. To some degree this is unavoidable, but with **OFF-AXIS CORRECTION** you can correct a lot of the differences in frequency and polar response resulting in a better mid-side recording.

OFF-AXIS CORRECTION can be particularly important for surround applications where there are a lot of overlapping polar patterns.

Proximity Effect

When recording in stereo with directional mics, the distance from the sources are often far enough to cause the bass response to drop significantly, due to the proximity effect. For many directional mics, the flattest bass response is around a 0.5 m from the source.

Sphere technology lets the user directly adjust the amount of proximity effect, so the bass response can be flat, or even boosted, at farther distances. In the Sphere plug-in, turn the **PROXIMITY** knob in the positive direction. This can create a much fuller sounding recording.

When using conventional mics, one approach is to add spot mics for low frequency sources, such as a kick drum. This can work well, but there is always some risk of phase issues occurring between the spot mics and the distant stereo mics, because of their different time alignment (about 1 ms per ft of separation).

Appendix A: Troubleshooting

Table A-1 Troubleshooting Guide

Problem	Possible Cause	Solution
No signal from microphone.	Microphone is not receiving 48-V phantom power from the preamp.	Use the supplied XLR breakout cable to connect the mic to the preamp inputs; enable phantom power on both channels.
Sound is muffled and reverberant.	Sound is coming into the rear of the microphone.	Rotate the mic 180° so sound enters the front.
	Input channels are swapped.	Make sure the Front output is routed to the Left input of the plug-in, and the Rear output is routed to the Right input. For more information, see *Preamp Calibration* on page 13.
Sound is distorted.	Preamp input gain is too high.	Reduce the preamp gain on both mic channels.
	SPL at mic is too high.	Set the Attenuation switch on the mic to the **-10** or **-20** dB setting.
	Output level of preamp is too high, causing clipping of the A/D converters.	Lower the preamp level until the distortion disappears.
	Output level of Sphere plug-in is too high, causing clipping of the A/D converters.	Lower the plug-in output level until the distortion disappears.
Mic modeling from plug-in output does not sound normal.	Only one channel of the microphone is connected/ powered and routed to the plug-in.	The Input meter at the bottom of the plug-in shows audio level to both channels: The top and bottom of the meter show the left and right channels, respectively. If the plug-in is not receiving audio on both channels, check that both mic channels are connected to the preamp, and the preamp is connected to your DAW.
	The gain levels of the preamp channels are not properly matched.	See *Preamp Calibration* on page 13 to learn how to match your preamp levels.
	Microphone is in calibration mode.	Move the calibration switch on the mic to the **NORM** position.
	The mic outputs are swapped.	Make sure the Front output is routed to the Left input of the plug-in, and the Rear output is routed to the Right input. For more information, see *Preamp Calibration* on page 13.
	The signal chain includes another plug-in or outboard processor that precedes the Sphere plug-in.	See *DAW Signal Chain* on page 26 to learn how to route your plug-in.

Appendix B: Sphere L22 Specifications

Sphere L22 Microphone	
Equivalent Noise Level	7 dB-A
Max SPL (0.5% THD)	140 dB (with -20 dB pad switch engaged)
Pad Attenuation	-10 dB and -20 dB
Sensitivity	22 mV/Pa
Output Connector	5-pin XLR (male)
Breakout Cable	10-ft 5-pin XLR (female) to dual 3-pin XLR (female)
Output Impedance	200 Ω
Recommended Load Impedance	> 1000 Ω
Phantom Power	**Voltage**: 44–52 V per channel **Current**: 5 mA per channel (typical), 8 mA per channel (max SPL)
Sphere DSP Plug-In	
Supported Formats	UAD, AAX Native, VST2, VST3, Audio Units (Mac only)
Supported Operating Systems	Mac OSX 10.8.5 and above Windows 7 and above

Appendix C: Installed Locations

During installation, the Sphere Native plug-ins and uninstaller are copied to these locations on the hard drive.

For UAD installed locations, see the *UAD System Manual*: http://www.uaudio.com/support/manuals.html

Windows

C:\Program Files\Townsend Labs\Sphere

The plug-in files are installed to the following locations:

- **64-bit VST plug-ins directory**: C:\Program Files\Steinberg\VstPlugins\
- **32-bit VST plug-ins directory**: C:\Program Files (x86)\Steinberg\VstPlugins\
- **VST3 plug-ins directory**: C:\Program Files\Common Files\VST3\
- **VST3 (x86) plug-ins directory**: C:\Program Files (x86)\Common Files\VST3\
- **AAX 64 plug-ins directory**: C:\Program Files\Common Files\Avid\Plug-Ins\
- **AAX 32 plug-ins directory**: C:\Program Files (x86)\Common Files\Avid\Plug-Ins\

Mac

Macintosh HD/Applications/Townsend Labs/Sphere

The plug-ins are installed to the following standard OS X locations:

- **VST**: /Library/Audio/Plug-Ins/VST/
- **VST3**: /Library/Audio/Plug-Ins/VST3
- **Audio Units**: /Library/Audio/Plug-Ins/Components
- **AAX**: /Library/Application Support/Avid/Audio/Plug-Ins