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Royer Labs R-122 Active Ribbon Microphone

A new concept in ribbon mics makes a big splash

Review by Rich Sanders

On February 1, 2002 Royer Labs introduced a new concept in ribbon microphones, the R-122. The R-122 is a monaural phantom-powered active ribbon microphone. It follows in the tradition of the popular Model R-121, a normal non-powered ribbon mic. It has a bi-directional pickup pattern, operates from standard 48 V phantom power, can withstand SPL greater than 135 dB SPL and recommended applications include most studio applications and direct to two-track live recordings. For the purpose of our testing Royer also included a Model R-121 for comparison.

Is there any significant difference between a powered and non-powered ribbon microphone? And how does this microphone compare to other quality studio microphones?

About ribbon microphones

Perhaps a little history lesson is warranted here for those of you who might be more familiar with the more popular dynamic and condenser models than with ribbon mics. Although most modern ribbon mics are fairly tolerant to shock and vibration, they can be a bit more sensitive to direct blasts of air such as plosives from vocals or some percussion and wind instruments.

The natural pickup pattern for a ribbon mic is bi-directional, also called figure-eight, which is the case with the Model R-122. This pattern exhibits very strong signal rejection from the sides. It also typically has less off-axis coloration, especially at high frequencies. The ribbon inside the mic can become stretched if the ribbon is not protected. It is therefore standard practice to cover a ribbon mic with a sock when not in use. None of these issues are good or bad, but they are characteristic of ribbon mics.

There is another common characteristic of ribbon mics that has to do with the loading of the microphone by the mic preamplifier. It is important to understand this difference from moving-coil dynamic and condenser microphones. A ribbon mic is a dynamic mic that uses a flat, low-mass ribbon in place of a moving-coil assembly.

Condenser mics have a preamplifier, usually built in prior to the microphone output. This enables them to have a much higher output level than any of the dynamic mics. This preamp also isolates the capsule of the mic from the preamp, which makes the loading less critical. Most non-active ribbon mics generate a signal approximately 20 dB less than a condenser mic. Therefore, ribbon mics need lots of gain, and, to get a clean audio signal, very quiet mic pres are needed.

Ribbon mics need a preamp with high input impedance, on the order of five times the output impedance of the mic. Most ribbon mics' output impedance is between 200–300 ohms, so the preamp needs to be about 1,500 ohms. If this does not happen, there will be a low frequency loss of the audio signal.

[For more technical details specific to the new designs by Royer see the sidebar.—Ed.]

The Royer R-122

The R-122 is different from the traditional ribbon mic because it has a preamp built into the mic. It uses the same ribbon assembly as the R-121, a 2.5-micron aluminum ribbon with Rare Earth Neodymium magnets. The stated frequency response is 30–15,000 Hz $\pm$ 3 dB. The output impedance is 200 ohms, the same as most condenser microphones. The maximum SPL is greater than 135 dB and is phantom powered by 48 V only. The R-122 is heavier than it looks at 309 grams or 10.9 oz., and is available in burnished satin nickel (supplied) or matte black chrome finish. It comes in a protective wood case with microphone sock and a lifetime warranty to the original owner.

The R-122 on electric guitar

The day the mics arrived we had an overdub session with electric guitar. Mario, our senior engineer, set up the R-122s in a standard Mid-Side (M-S) arrangement and liked the sound so much he did not even try anything else. The information that comes with the mic is quite helpful, offering many suggestions, which Royer recommends as required reading. The electric guitar with the M-S technique sounded huge, warm, and still had plenty of punch. The mics were about three feet in front of the guitar amplifier. The bi-directional ribbons give lots of control in the studio with the M-S technique.

The R-122 on acoustic piano

A couple of days later we tested the R-122 on acoustic grand piano. We took the time to try a few techniques and placements. First, we set up a monaural test with the R-122, a Neumann KM 184 and a Neumann U 87. Both of the Neumanns are condenser mics. The KM 184 is cardioid

pattern only and we used the U 87 in a bi-directional pattern. The mic placement was in front of the open piano lid. They all sounded good, with significant difference being the warmth of the R-122 compared to the condensers. A ribbon mic will seldom be brighter than a quality condenser microphone. The "art" of using mics has to do with selecting the right mic for the most appropriate sound.

Next, we compared the R-122s in an M-S configuration, alongside the U 87s in M-S with both U 87s in bi-directional mode. Here again, the major difference is in the warmth of the R-122s. The R-122 setup we used is shown in Picture 1. The warmth of the R-122s gives a very pleasing sound. It does not feel like the high end is missing, but offers a warm sound with plenty of clarity and transparency. Ribbon mics have a proximity effect boost when used less than three feet from the sound source, depending on the source.

When finished with the M-S technique, we tried the Blumlein technique. The Blumlein technique is a near-coincident pair in a similar setup to the M-S technique, except that the mics are assigned to the left and right channels only, and the left and right sides are pointed 45 degrees to either side of the center. Figure 2 shows the difference between the M-S and Blumlein techniques. The Blumlein technique worked very well in our piano setup and I would recommend trying it. This technique is more dependent on the room than the M-S technique for its success. If you do not like the sound of the room in which you are recording, it may not work as well as the M-S technique.

We also tried the R-122s as a spaced pair inside the piano. This might work on some pianos, but due to the bi-directional pattern it seems to have a hollow sound on our piano. However, a spaced pair in front of the piano sounds very good. The spaced pair technique does not give you the same control as the M-S technique, but it does have a nice sound. One other thing we tried was an X-Y pair inside the piano because it is a common technique with cardioid-pattern microphones. It is not recommended with any bi-directional pattern microphones because of the hollowness that you get, while having so much information from the rear of the microphone. We concluded that this technique did not work well in our piano.

The R-122 on acoustic guitar

We did a similar test on acoustic guitar as we had done on the piano. First, we put up monaural versions of the R-122, KM 184, U 87 and this time included the non-powered Royer R-121 ribbon mic. The R-122 sounded warmer than the condensers, but with just as much detail. If you need an acoustic guitar to sound brighter, a condenser mic is a better choice. However, if you

have a bright steel-string acoustic guitar the R-122 is an excellent choice. The M-S technique also works well here if you do not have to worry about acoustic bleed or can use appropriate baffling.

On the acoustic guitar we tried the suggestion found in the manual of using the backside of the mic to get a brighter sound. Both the R-121 and R-122 use an "offset ribbon" design that Royer says enables the mic to handle high sound pressure levels. A by-product of this design gives the backside of the mic a somewhat brighter sound than the front side. This is only noticeable inside the proximity effect range of three feet or less. We found this to be true on the acoustic guitar. In fact, on the acoustic guitar we recorded it was an improvement.

An interesting side note is that the R-122 and the R-121 sound nearly identical. The only difference is the output level and associated noise floor. The output of the R-122 is a little over 15 dB greater than that of the R-121. The noise floor of the R-121 is still very low when used with a quality mic preamp with proper input impedance. Modern ribbon mics typically have low self-noise so this works well, but the R-122 is at least 15 dB quieter.

The R-122 on drums

We tried two R-122s as overhead mics in a spaced pair on a drum set. In this particular case we went back to a spaced pair of small-diaphragm condensers. However, in a different room they could have sounded fine. The frequency response was very nice, but the figure-eight pattern of the R-122s produced a slight hollowness. Depending on the situation, it is certainly worth trying. The R-122 for location stereo recording

We did not have the opportunity to record direct to two-track on location or in the studio. This application has typically been a problem for ribbon mics because of their low output levels, potential impedance matching with the preamp and long cable runs. The R-122 with its built-in preamp has eliminated these problems.

I would like to try a pair of R-122s in a direct to two-track recording and I suspect they would work well in M-S, Blumlein or spaced pair techniques, depending on the room and the situation. I also would like to try them as surround microphones for a 5.1 surround sound recording. Again, any of the above mentioned techniques should work very well.

Royer Demonstration CD

John Jennings at Royer Labs was kind enough to visit with me about the R-122. He also sent along a copy of the Royer Demonstration Compact Disc. There are many examples on this CD

of most everything you would want to record, along with comparisons to other microphones. The CD was recorded with the R-121 before the R-122 was introduced. It is an excellent demonstration of the R-121 but also of ribbon mics in general. If you are new to using ribbon mics, I would recommend the free CD to you. You can contact Royer Labs for your free copy.

Conclusions

If you are a fan of ribbon mics, one or two of the R-122s should be included in your collection. If you have not been a fan of ribbon mics or have never tried them before, this mic could change all of that. The R-122 has a warm, smooth, natural sound that is always useful, especially with all of the digital recording going on these days. It will not replace your condenser or moving-coil dynamic mics, but will add great flexibility to your mic collection. The new features—higher output, lower noise, and no impedance matching problems—make this mic easy to use and a great addition to your tool set.

This microphone is not cheap at a MSRP of \$1,695, but if you are recording acoustic instruments of any kind it is well worth the price.

More from: Royer Labs, 821 N. Ford St., Burbank, CA 91505. 818/760-8472, fax 818/760-8864, www.royerlabs.com.

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[The Royer R-122 employs new technology best explained by the manufacturer. This is what Rick Perrotta of Royer Labs offers to our technically-minded readers. Ed.]

R-122 —A Few Critical Points

The R-122 is the first phantom powered ribbon microphone ever made. We see active ribbons as a logical advancement in ribbon microphone technology; not replacing un-powered ribbons, but broadening where and how ribbon microphones can be used. In particular, one's choice of microphone preamplifier now becomes a matter of taste when recording lower SPL sound

sources, as opposed to the ultra-high-gain mic pre's required for non-powered ribbons on softer recordings.

The phantom powered head amplifier system in the R-122 is a fully balanced, discrete design that utilizes ultra-low noise FETs and a specially designed toroidal transformer. This system does two things: 1) it makes the microphone 15 dB more sensitive than non-active Royer ribbons, raising the mic's sensitivity to typical phantom powered condenser microphone level, and 2) its "Z-match" feature presents an optimal impedance to the ribbon element at all times, as well as providing a low impedance output that allows for long cable runs with minimal signal loss.

All of the R-122's gain comes from its specially designed toroidal transformer. This transformer produces a significant voltage gain across the full audio bandwidth, but its output impedance is too great to be usable without an active buffer stage. The balanced FET amplifier (which actually has a gain of less than one) provides very high source impedance to the transformer, leaving the transformer effectively unloaded except for the resonant tuned load of the ribbon element. This condition allows the full voltage gain achieved by the transformer to be utilized. The FET's drive a pair of balanced bi-polar emitter followers that provide a low impedance output to the outside world. The amplifier's job is to act strictly as a buffer-driver, so thermal noise from the FET's and transistors is negligible. The "Z-match" feature makes for the greatest difference between powered and un-powered ribbon microphones. Z-match sets the impedance presented to the ribbon element so that it is always in an optimal state. Regardless of the mic pre you plug an R-122 into, as long as the mic is fed phantom power, the ribbon element will always operate at full potential.

With conventional ribbon microphones, the input impedance of your mic preamplifier directly affects the ribbon element. If the impedance presented the ribbon is too low, the ribbon will become overdamped; losing sensitivity (as much as 6 to 8 dB), bottom end, and overall sparkle. The microphone will sound somewhat weak and unimpressive. If the impedance is a good match (typically five times the impedance of the microphone), the ribbon element will be properly damped and able to operate at full potential. The microphone will sound rich and alive. Z-match assures a consistent level of high performance from the microphone by eliminating the possibility of a less than perfect impedance match to the ribbon element, regardless of your choice of mic pre.

Sonically, the difference some engineers hear between the R-121 and R-122 is that the R-122 gives a somewhat more focused bottom end and more apparent high end. This is all coming from the toroidal transformer, with its greater size and faster transient response.

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