

PHAZEQ™ 500 Tool

Phase Alignment Tool & Filter

500 Series Module



User Guide

Radial® PHAZEQ™ 500 User Guide

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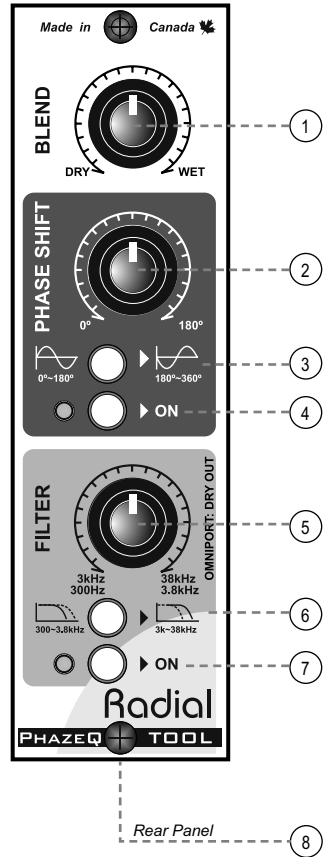
Congratulations and thank you. You are now the proud owner of the Radial PhaseQ™ 500, one of the most intriguing products we have ever developed. Why intriguing you ask? Well, simply stated, messing around with phase is kind of like bending time. Mother Nature really gets upset when we do these things! And to add even more confusion, we are not merely messing with the phase between two microphones, the PhaseQ can actually be used as a whacky equalizer! So hold onto your hat... this ride will be fun.

To get you there as safely as possible, we recommend that you take the time to read this manual. This will give you some insight on how to use the PhaseQ and what is actually going on when you move the dials. If by chance you do not find all of the answers you are looking for, please visit the FAQ page at www.radialeng.com. This is where we post the latest bits and pieces of information. Then, if you don't find what your are looking for there send us an email at info@radialeng.com and we will do our very best to respond to you in short order.

Fasten your seatbelts, set the time-bend constant to year 3022... and then close your eyes. Listen. Reality just got a whole lot more exciting!

FEATURE SET

1. BLEND – Controls the mix between the original (dry) signal and the phase altered (wet) signal.
2. PHASE SHIFT – Used to set the phase relationship between the dry and wet signals or between two devices when using a stereo source.
3. INVERT - 180° polarity reverse shifts the phase shift range from 0° to 180° to 181° to 360° for control over the complete frequency cycle.
4. ON (phase shift) – Used to bypass the phase shift section and compare the original sound with the phase altered signal.
5. FILTER – Sets the high frequency cut off range of the low-pass filter. This lets you apply the phase effect to lower frequencies.
6. SHIFT - Changes the filter range from the high range (3kHz to 38kHz) to the low range (300Hz to 3.8kHz)
7. ON (filter) – Used to bypass the filter section and compare the processed signal with the original.
8. OMNIPOINT - Available when used with the Radial Workhorse, the Omnipoint is assigned as a direct dry signal output for re-patching to other devices.

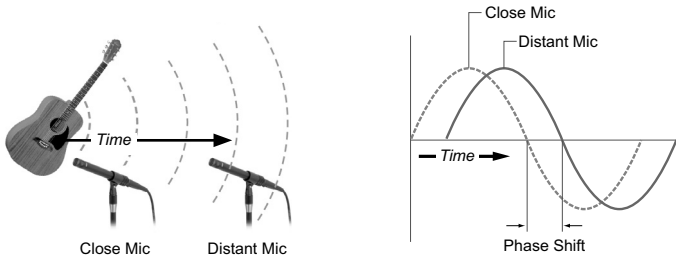


OVERVIEW

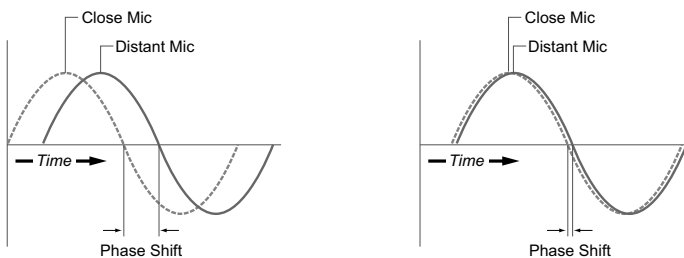
The PhazeQ can be considered as two different devices in one. Its primary task is to provide added realism by allowing two sources to be brought together in such a way that their fundamental frequencies combine in harmony. Analogue phase control should not be measured... you must listen and decide. The other side of the PhazeQ is destructive creativity. In other words, we invest all kinds of time and energy trying to ensure the audio signals are perfectly phase-aligned and then... the PhazeQ lets you completely ruin this by allowing you to introduce radical sounding EQ curves via phase cancellation. It truly is a case of good and bad in one box.

Phase Alignment - The good!

When two microphones are placed in a room, depending on where they are positioned with respect to the source, the sound will inevitably arrive at a different time as it travels through the air. When the two microphone signals are mixed together they will inevitably be out of phase. This causes an effect known as comb-filtering.



By altering the phase (or delaying the sound) of the nearest microphone, you can shift the fundamental frequency so that it will more gracefully combine with the sound being captured by the second microphone.

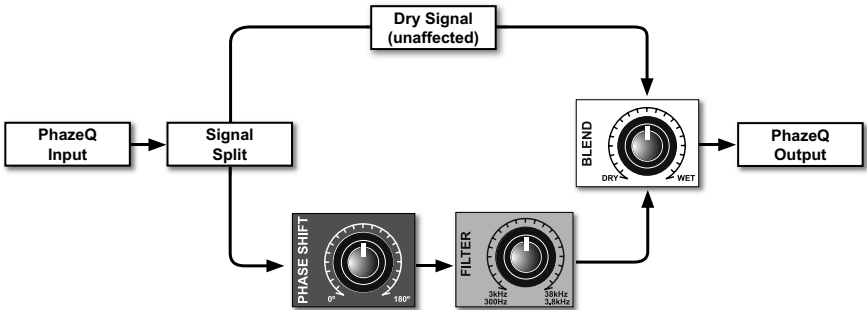


What is surprising is that this effect is not merely intended for mics that are broadly spaced, but the effect is just as astounding on microphones that are close together such as an XY configuration. The effect is even more pronounced when combining a direct signal such as from a direct box with a room microphone. Engineers will often spend hours moving mics to capture the perfect tone. The PhazeQ lets you quickly do it by turning a dial.

PhazeQ as an EQ - The Bad!

As soon as you change the EQ setting on your mixer, you are in fact messing with the phase. This is the nature of the beast. Most EQ circuits are designed to minimize phase shift for this very purpose. In fact, EQs like the Radial Q3 Induction Coil EQ are sought after for this reason. They introduce less phase alterations.

The PhazeQ can be used as a radical EQ by splitting a signal in two, keeping one dry (unaffected) and then phase cancelling the second. One merely adjusts the wet/dry ratio with the BLEND control to set the intensity of the effect.



What happens here is that you can cancel or augment certain frequencies to create radical sounding curves. For instance you can remove a bunch of mid-range to create a huge FM broadcast voice. In other words, we have purposely created a tool that will cause phase cancellation as a means to create new sounds, all the while in the analogue domain.

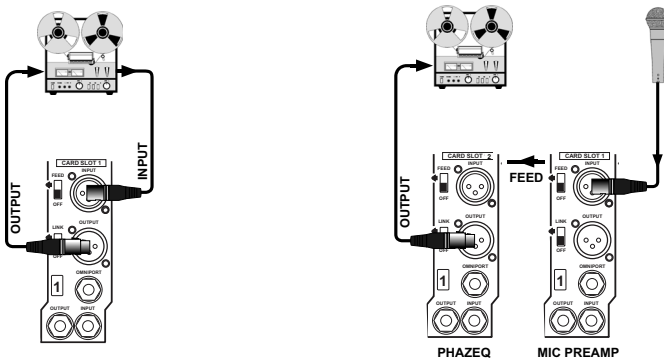
To get a true feel as to where the PhazeQ can go, you have to start turning knobs. And if you start with the understanding that it is impossible to get everything in phase (*because all frequencies have different wavelengths*), you will be able to sleep much better at night. Let's have fun!

GETTING STARTED

Making Connections

Before making any connections, start by turning off your audio system and turning all volume levels down. This helps protect equipment from turn-on transients that could damage loudspeakers and other sensitive equipment. We recommend using a power bar with an on-off switch as this makes it easy to turn on and off the 500 series rack, monitors and so on, using a single switch. Carefully plug the PhazeQ into your 500 series rack avoiding stress on the card edge connector. Screw the module in to ensure it does not accidentally become dislodged.

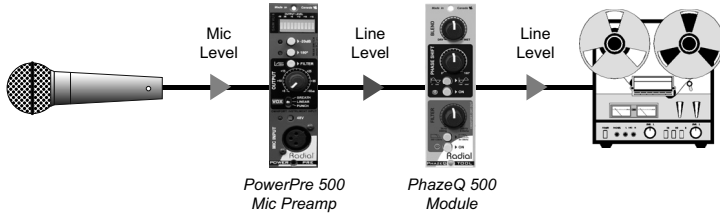
Connections between the PhazeQ and the recording or PA system are made at the rear panel of your 500 series rack. Most 500 series racks are equipped with XLR connectors. When you plug the PhazeQ module into your 500 series rack, it will automatically route the card-slot input and output XLR jacks to the module. With the Radial Workhorse 500 series rack the I/O is augmented with 1/4" TRS connectors, D-Subs and the Mix Buss signal to feed the Workhorse mixer.



Start by setting up the PhazeQ panel controls as follows:

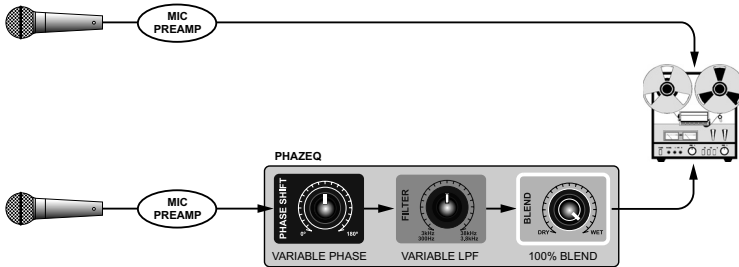
1. BLEND: set to the 50% position (12 o'clock)
2. PHASE SHIFT: set to zero degrees (7 o'clock)
3. INVERT: outward position (0° ~ 180°)
4. ON: outward position (PhaseQ bypassed)
5. FILTER: set to fully clockwise
6. RANGE: outward position (300Hz ~ 3.8kHz)
7. ON: outward position (filter bypassed)

The PhazeQ is a professional line level device designed to be used with the Radial Workhorse or other 500 series rack. This means that it is intended to process signals from +4dB balanced line sources such as the output from a recording system, mixing console or mic preamplifier.

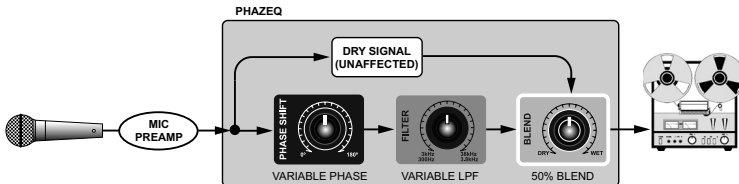


Connect the source signal to the PhazeQ by plugging into the XLR male input of your 500-series rear panel. If you have a Workhorse, the channel to the left can also supply a signal to the PhazeQ via the FEED connection. Connect the XLR output to the recorder.

The PhazeQ can be used as either a phase adjustment tool or as an equalizer. The difference between the two is simple: when phase adjusting, you are basically bringing two different sources into phase while as an EQ, you are taking one source, splitting it in two and then recombining to create an effect.



PHASE ADJUSTMENT: This setup shows how one microphone's signal is phase shifted compared to the other. The two signals are combined together at the mixing console or recorded to one track.



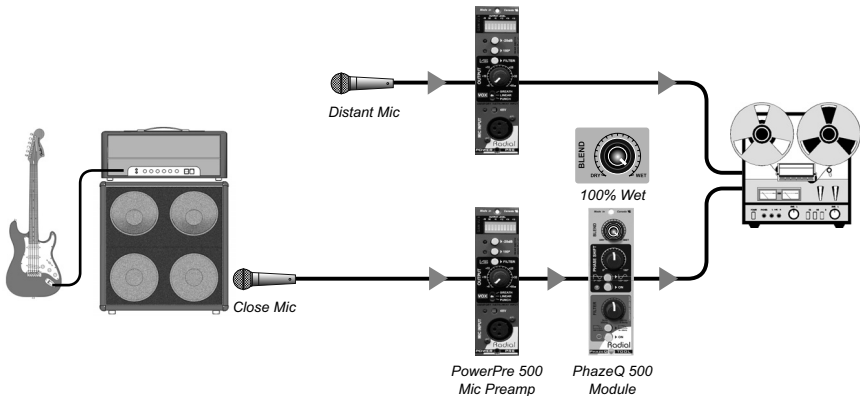
EQ AND TONE SHAPING: With a single microphone the BLEND control is used to mix the original and phase shifted signals together. This combined with the LPF filter can create a variable EQ that uses phase cancellation to shape the sound.

Using The PhazeQ As A Phase Adjustment Tool

When recording, two mics are often combined to capture different parts of the instrument. For example, on a guitar you may want to pick up sound from both the hole and the bridge. On a piano, you may have one mic capturing the bass registers while a second mic captures the highs. Spill from the instrument will invariably feed both microphones. This means that some frequencies, when combined will be in phase and therefore reinforce each other and become louder, while some will cancel each other out and be attenuated. Moving the microphones around will change the sound.

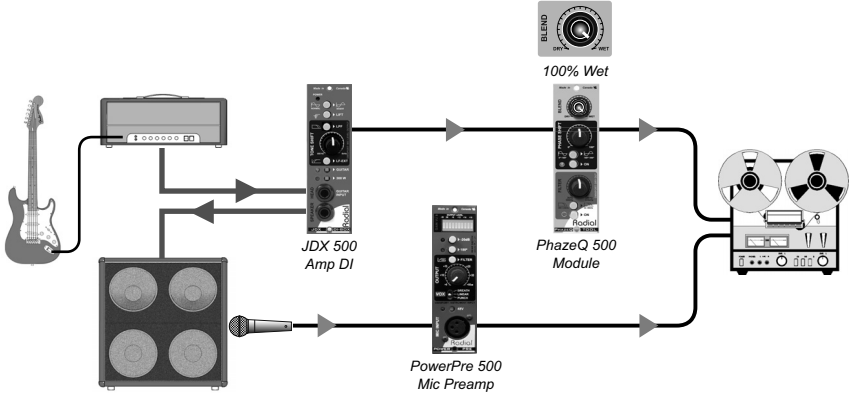
This happens because each frequency has a different wavelength and the relationship between the many frequencies will cause them to combine or cancel depending on their relative phase. Engineers will often take hours moving mics around the room trying to find the ideal mic positions. The PhazeQ is basically an electronic device that does the same thing: it lets you move the mic around electronically with surgical precision. What it will not do is fix the relationship between the two sources. This is impossible as each frequency has a different wavelength and they go on forever. With a PhazeQ, you will actually have to use your ears and listen to find the sweet spot that works.

A common set up would be to load your 500 series rack with two PowerPre mic preamps and a PhazeQ. You would connect each microphone to a preamp and feed the signal from the preamp that is **closest to the source** into the PhazeQ. Both outputs would then feed to separate channels on your recording system. Set the BLEND control to wet, the phase adjustment counter-clockwise, and make sure the low-pass filter is off. Bring up the level on the direct (far) mic to make sure it is working. Then, bring up the level on the 'mic to PhazeQ' channel (near). Set both channels to about the same level, turn on the phase adjustment tool and rotate the control clock-wise.



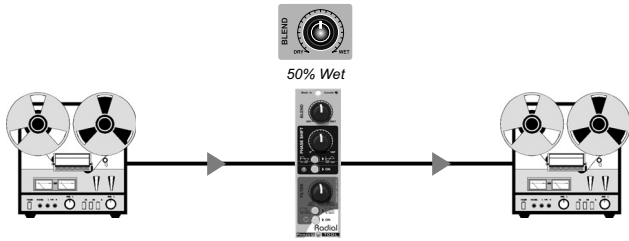
You will find that most of the audible effect will be from 7 o'clock to 12 o'clock as this is where the bass frequencies are affected. As you move the control all the way clockwise (to 5 o'clock) the audible effect will diminish as it only affects the higher frequencies. This is because the human auditory system (our ears and brain) is most sensitive to phase shift at lower frequencies. Try depressing the 180° switch. This will reverse the polarity of the signal from 0° to 180° to effectively shift the phase between 181° to 360°. The effects can be dramatic, weird and very pleasing. There are no rules... just fun!

Another great application is combining the direct feed from a guitar amp with a mic. One of the most difficult sounds to capture is an electric guitar. This is because the sound that the guitarist hears comes from a combination of the amp, the distance he is standing away from the source and the room itself. Take a direct feed from the amp using a Radial JDX Reactor. Feed this into the PhazeQ and set up a second mic in front of the amp or in the room. Combine, mix and phase adjust and you will be amazed at how quickly you can take a very basic sound and turn it into a monster. The same works on bass, kick drum, piano... once you try it you will never record without one. It is truly addictive!



Using The PhazeQ As An Equalizer

Connect a source or pre-recorded track to the PhazeQ and then send the output to a single channel on your mixer. Start by setting the phase adjustment counter-clock wise, 180° out, and filter off. Set the BLEND control counter-clockwise so that you will only hear the dry sound. Check to make sure you have signal. Turn on the phase, set the BLEND control to 12 o'clock, and slowly rotate the phase adjustment tool. You will immediately hear the effect. By adjusting the phase control, you are basically moving the phase cut-off point. You can increase or decrease the effect by adjusting the BLEND.



A pleasing effect is to phase cancel frequencies in the mid range. Because we humans are more sensitive to mids (as this is where we communicate), cutting the mids can make our voices sound big and brash... or give the character of an FM Radio DJ. This can be effective on acoustic instruments, drums and all types of other instruments. The only way to really understand how this works is by trying it. The more you play with it, the more you will begin to realize the scope. It is huge.

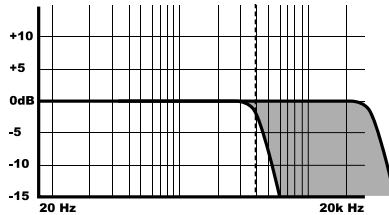
Using The Low-pass Filter

For even more fun, you can bring in the low-pass filter. This is basically a filter that removes high frequencies from the phase shift circuit. It is set with two ranges so that you will be able to apply a slight, yet well controlled roll off in the upper registers or apply brute force to the mids and low end. In either case, the intent is to focus the phase effect while leaving the highs alone. The controls let you decide where the effect will occur.

RANGE



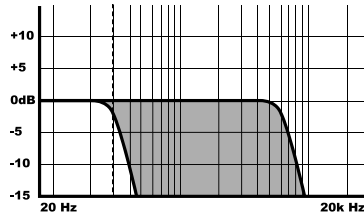
*Filter Range
3kHz - 38kHz.
Subtle filtering*



RANGE



*Filter Range
300Hz - 3.8kHz.
Extreme filtering*



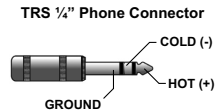
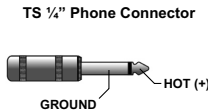
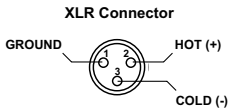
When using the phase, set it fully clock-wise to 5 o'clock and then slowly dial it in backwards. As you move the control counter-clockwise, you will attenuate the high frequencies which means that the direct (un-phased) signal will no longer be competing with the out-of-phase signal. This can be particularly advantageous with acoustic instruments that are more phase sensitive in the upper registers. Once again there are no rules, only choices.

Thank you for taking the time to read through this manual. The suggested uses and applications outlined are simply an introduction to the capabilities of the PhazeQ 500 module. Enjoy!

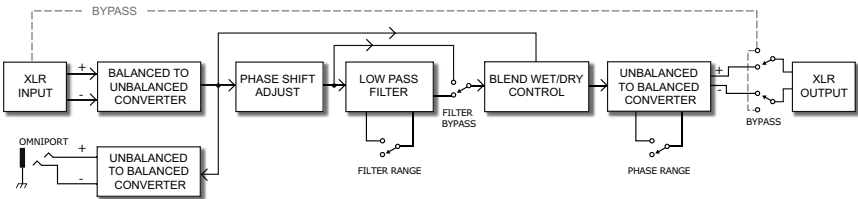
PHASEQ 500 MODULE SPECIFICATIONS*

Circuit Type:	Discrete Component Class A
Frequency Response:	20Hz~20KHz
Dynamic Range:	102dB
Noise - Dry:	-90dB below 0dBu
Noise - Wet:	-80dB below 0dBu
Maximum Output:	+17dBu
THD+N - Dry:	>0.002% @1kHz (0dB input, 100k load)
THD+N - Wet:	>0.015% @1kHz (0dB input, 100k load)
Intermodulation Distortion:	>0.015% @ -12dBu out
Input Impedance:	3.4K Ohms
Output Impedance:	110 Ohms
Phase Shift (wet):	Range 1: 12 to 180 degrees Range 2: (inverted) 192 to 360 degrees
Low Pass Filter:	Range 1: 300Hz ~ 3.8kHz Range 2: 3kHz ~ 38kHz
Omniport:	Dry Signal, Balanced Output, +15dBu
Power Requirement:	50mA
Shipping Weight:	1.5 lbs. (0.7 kg)
Warranty:	3 Years, Transferable

CONNECTOR WIRING



BLOCK DIAGRAM*



* Subject to change without notice.

THREE YEAR TRANSFERABLE LIMITED WARRANTY

RADIAL ENGINEERING LTD. ("Radial") warrants this product to be free from defects in material and workmanship and will remedy any such defects free of charge according to the terms of this warranty. Radial will repair or replace (at its option) any defective component(s) of this product (excluding finish and wear and tear on components under normal use) for a period of three (3) years from the original date of purchase. In the event that a particular product is no longer available, Radial reserves the right to replace the product with a similar product of equal or greater value. In the unlikely event that a defect is uncovered, please call 604-942-1001 or email service@radialeng.com to obtain an RA number (Return Authorization number) before the 3 year warranty period expires. The product must be returned prepaid in the original shipping container (or equivalent) to Radial or to an authorized Radial repair centre and you must assume the risk of loss or damage. A copy of the original invoice showing date of purchase and the dealer name must accompany any request for work to be performed under this limited and transferable warranty. This warranty shall not apply if the product has been damaged due to abuse, misuse, misapplication, accident or as a result of service or modification by any other than an authorized Radial repair centre.

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This product is intended for professional use only.
The user should be familiar and experienced with
the 500 series rack and module format



True to the Music

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