

Phazer[™]



Owner's Manual

Radial® Phazer™ Owner's Manual

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INTRODUCTION

Congratulations on your purchase of a Radial Phazer. The Phazer is a phase adjustment tool that allows you to quickly align the phase response of two audio signals to fatten and create more natural tones. We recommend that you take a few minutes to read through this manual in order to familiarize yourself with the many innovative features incorporated into the Phazer.

Should you have a question or an idea for an application not covered in this manual, we invite you to log onto the Radial web site at www.radialeng.com to check the Phazer's FAQ section for more info and the latest updates. Of course, you can also send us an email at info@radialeng.com and we will do our very best to respond to you promptly. Now get your mic's, DI's and mixer revved up and get ready for some real tonal fun!

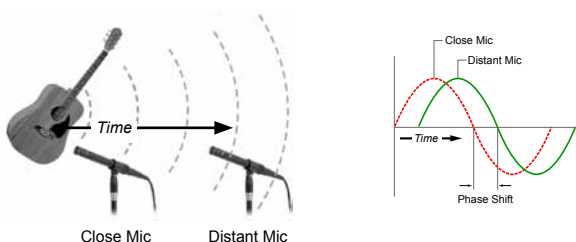
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OVERVIEW

The Phazer is a real-time analog phase adjustment tool with 100% discrete class-A circuitry for great sound. The Phazer gives you a quick and easy means to experiment with the creative use of phase shift and it inspires new sounds when working with your favorite mics and Radial direct boxes.

Its purpose is to shape the sound by shifting the phase of one signal against another, allowing you to tune the overall phase-response of the combined signals. The Radial Phazer is capable of shifting the phase continuously over the complete 360° range. You simply dial in the amount of phase shift that sounds best to your ears.

For instance, an engineer may use two mics to record an acoustic guitar. The first mic is placed close to the sound hole and a second mic is located further away from the guitar. Because the sound waves take a little longer to reach the more distant mic, its signal is slightly delayed compared to the close mic.



This minute delay creates a phase shift between the two mic signals that colors the tone through a type of phase cancellation known as comb-filtering. The Phazer exploits this phenomenon and presents it as a simple, fun and musical tool for the audio engineer.

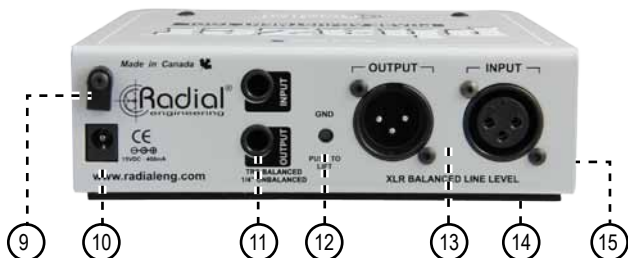
For instance, the Phazer can be used to shift the close mic's signal into alignment with the distance mic to create a fuller, richer sound when the two mic signals are combined. Alternatively, it may be used as an effect to intentionally shift the phase and create new unique tones.

The more you use the Phazer the more you will come to appreciate the creative options that are uncovered. When you think about it, creativity is what making music is all about.

PHAZER FEATURES AND FUNCTIONS



1. **PHASE-ON WITH LED:** Activates the phase section. LED illuminates when engaged.
2. **INVERT SWITCH:** Flips the phase range of the SHIFT control from 0° - 180° to the 181° - 360° range at the XLR output.
3. **SHIFT CONTROL:** Analog control used to adjust the phase shift.
4. **BLEND:** Lets you mix the original dry signal and the wet phased signal together.
5. **FILTER-ON WITH LED:** Bypass switch for the low-pass filter. LED illuminates when engaged.
6. **RANGE SWITCH:** Selects between two frequency ranges for the low-pass filter: 300Hz to 3.8kHz range or 3kHz to 38kHz.
7. **CUT-OFF CONTROL:** Adjusts the high-frequency cutoff point for the low-pass filter within the selected range.
8. **POWER SWITCH:** Turns on the Phazer. LED illuminates when unit is active.



9. **CABLE LOCK:** Used to clamp down the power supply cable to prevent accidental power disconnect.
10. **POWER SUPPLY CONNECTION:** Connection point for the included Radial 15VDC power supply.
11. **1/4" TRS PHONE JACKS:** Input and output connections for balanced +4dB and unbalanced -10dB signals.
12. **GROUND LIFT:** Helps eliminate hum and buzz caused by ground loops. Disconnects Pin-1 at the XLR and sleeve at the 1/4" TRS outputs.
13. **XLR JACKS:** Input and output connections for balanced +4dB signals.
14. **FULL BOTTOM PAD:** Neoprene no-slip pad won't scratch your surface.
15. **14-GAUGE STEEL ENCLOSURE:** With bookend shell creates a protective zone for the controls and switches.

CONNECTIONS

Before making connections, make sure all levels are turned down in order to prevent power-on and connection transients from damaging more sensitive components such as tweeters.

Power: The Phazer is powered by the included 15VDC/400mA supply. Do not substitute with another power supply. If you need a replacement please contact your dealer. The Phazer's power connection includes a cable lock feature that prevents accidental disconnection.



Use a hex driver to loosen the cable lock.

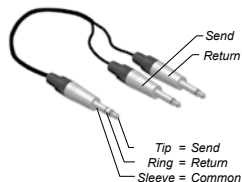
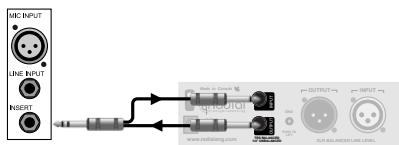


Pass the cable through and re-tighten.

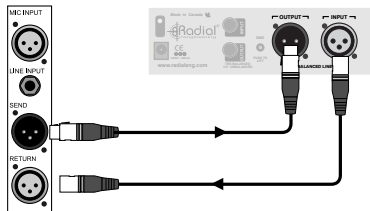
Audio: The Phazer is a line-level device that accepts +4dB balanced and -10dB unbalanced signals using either the XLR or 1/4" phone jacks. Balanced connections use the AES standard (pin-2 hot). There are two basic methods for connecting the Phazer:

1. Console Insert Connection - This is the most common connection. The Phazer is placed in the signal path using the 'insert' point at the console (studio patchbay).

Most consoles are equipped with an unbalanced single-point insert (-10dB) that employs a dual 1/4" to TRS connection as shown here:



Larger consoles sometimes employ balanced inserts with separate jacks (+4dB). These can be with either XLR or TRS Phone jacks.

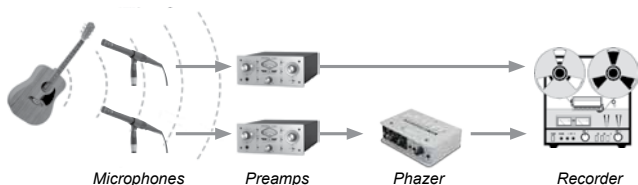


Contacts

	XLR	TRS
Pin 1	Common	Sleeve
Pin 2	Hot (+)	Tip
Pin 3	Cold (-)	Ring

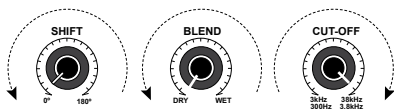
2. In-line Connection

The Phazer can be connected between line-level devices, such as between a mic preamp and a recorder. An example would be a stereo microphone setup where one mic is patched direct and the other is passed through the Phazer.

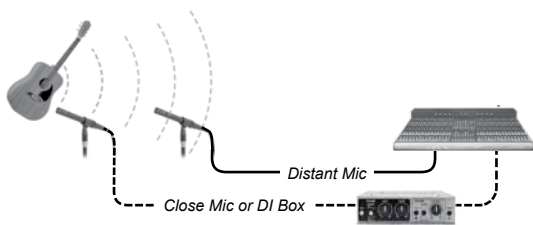


GETTING STARTED

1. Set all panel switches to the outward position (LED off).
2. Set the SHIFT and BLEND control fully counter-clockwise. Set the CUT-OFF control fully clockwise.



3. Insert the Phazer into the microphone or direct box channel you would like to phase align. Keep in mind that the Phazer should be processing the signal that arrives at the mixing console first. This would be the signal from the closest of the two mics, or a direct box since electricity travels faster than sound waves.

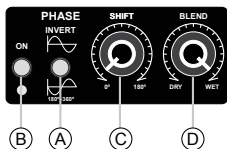


4. Activate the Phazer by connecting the power supply and depressing the POWER switch. The LED will illuminate.
5. Turn your audio system on and **test your connections at a low volume level**. If no sound is heard turn your equipment off and check the connections. If all is well turn the level up to a comfortable listening level. If you hear hum or buzz, try depressing the GROUND LIFT switch. You are ready to start using the Phazer.

ADJUSTING THE PHASE

The phase section is tuned by ear using two controls. To best hear the effect of each control set your mixer controls for both signals (one with the Phazer inserted and one without) to **equal** volume and **panned center** in your monitors, follow these steps.

Start with the INVERT switch (A) in the outward position and the SHIFT control turned full counter-clockwise. Make Sure the BLEND control (D) is also fully clockwise (WET).



Engage the PHASE ON switch (B), the LED will illuminate.

Slowly rotate the SHIFT control (C) clockwise while listening. Tune the control by ear to best suit the program material.

For the most part the goal is to shift the **close** mic signal until the fundamentals phase-align with the **distant** mic in a musical and pleasing way that compliments the instrument and program material. Keep in mind it is impossible for all frequencies to line up or be in perfect phase at the same time. When tuning the SHIFT control, simply use your ears to find what sounds best to you.

The Invert Function

The INVERT control is used to reverse the absolute phase of the signal passing through the Phazer and allow the SHIFT control to access the 181° to 360° phase range.

The INVERT switch can also be used for several clever functions. For instance, not all microphones and direct boxes produce the same polarity at their output. The INVERT switch can be used to correct the polarity of one device to match another.

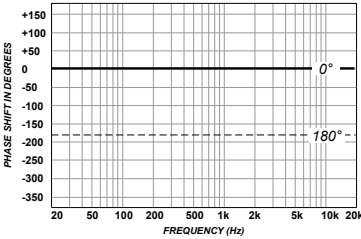
When listening for the 'sweet spot' it can sometimes be easier to hear phase cancellation rather than reinforcement. Employ the INVERT switch to help you tune the SHIFT control while listening for **maximum phase cancellation**. When you've found the spot that produces the weakest sound hit the INVERT button again and the effect switches from maximum cancellation to maximum reinforcement. This is most effective when tuning the effect to the fundamental frequency.

Using the Phazer as a creative EQ

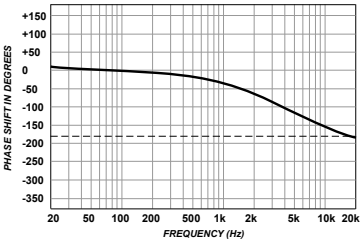
Filtering a signal through phase cancellation is one way to make tracks sit better in the mix without fighting with other instruments in the same register. Try phase shifting the rhythm guitar part while monitoring the other rhythm section instruments to see how you can change the balance without adjusting fader levels. The blend function lets you apply this technique using a single sound and phase 'canceling' to create an effect. It's fun!

ADJUSTING THE PHASE (continued)

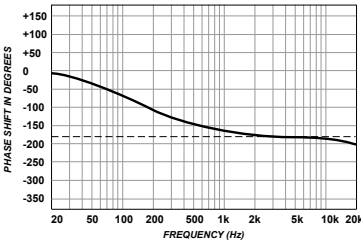
The following diagrams plot the phase response at different positions of the SHIFT control. The gentle curve displaying phase shift increases (in degrees) as the control is turned. Radial's unique phase curves and class-A analog electronics combine to make the Phazer sound musical.



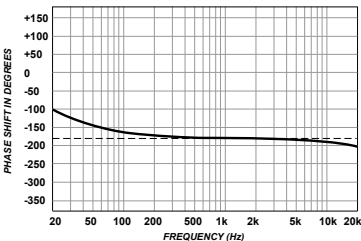
Bypass - zero phase shift, response is linear.



At this setting 200Hz is shifted by just one or two degrees while 20kHz is shifted 180°.



At this setting 200Hz is shifted by 100° while everything above 2kHz is shifted 180°.



Near maximum setting 200Hz reaches 180°.

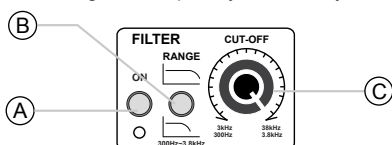
USING THE FILTER SECTION

Once you have found the 'sweet spot' in the phase shift section, try adjusting the low-pass filter controls to hear their effect. The filter section is designed to roll-off high frequencies above a variable cut-off point allowing the Phazer's effect to be focused on the fundamental frequencies. Before adjusting the filter section set the controls as follows.

Depress the filter ON switch (A), the LED will illuminate.

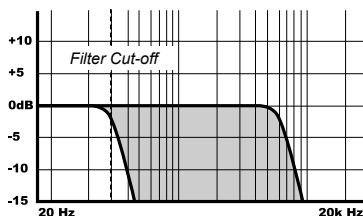
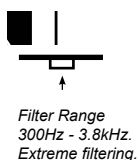
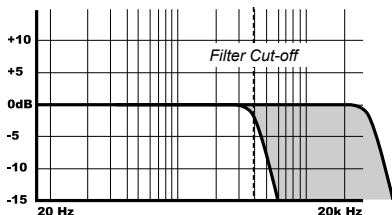
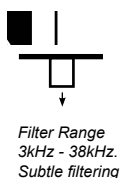
Set the RANGE switch (B) to its outward position. This sets the filter to it's highest frequency range, up to 38kHz.

Set the CUT-OFF control (C) to the maximum clockwise position. This sets the cut-off point to it's highest frequency allowed by the RANGE switch.



Slowly turn the CUT-OFF control counter-clockwise while listening to the effect. As you turn the CUT-OFF control counter-clockwise the filter moves downward through the spectrum removing frequencies above the cut-off point from the Phazer's output.

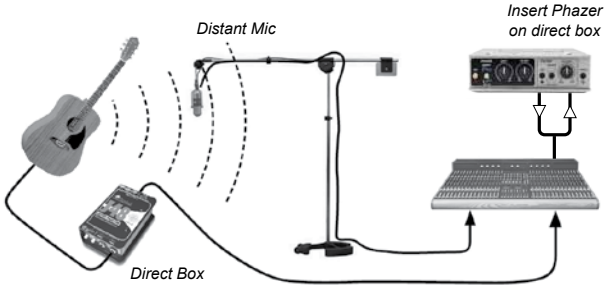
The filter offers two cut-off ranges accessed with the RANGE switch. When set to the outward position the filter will attenuate frequencies between 3kHz and 38kHz and produce a subtle effect on most instruments. When set to the inward position the filter affects the 300Hz to 3.8kHz range producing a more pronounced high frequency roll-off.



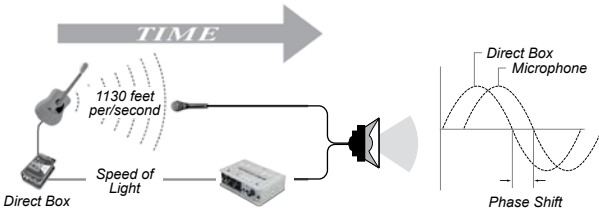
APPLICATIONS

Acoustic Guitar - Mic and Direct Box

A good application to try out the Phazer's capabilities is recording with a direct box and a microphone. Start by setting up a mic and a DI box and connect them to separate channels on your mixing console. Adjust both signals in the monitors to an equal level and panned to the center.



Once you have the DI and mic set up take a look at the time line below. It will help you understand what you are hearing. When the guitar is strummed the DI sends an electronic signal at nearly the speed of light while the mic has to wait for the slower sound waves to travel through the air. This creates a phase shift between the two signals that is measured in degrees. Listen for a few moments to the combined signals without the Phazer before continuing.



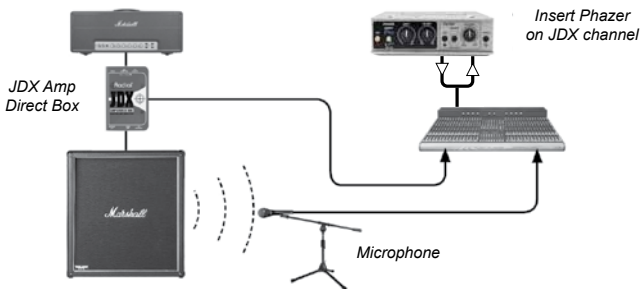
So, how does it sound? What you are hearing is the complex interaction between the DI, mic and the room causing phase cancellations at some frequencies and reinforcement at others. It may sound good or it may not. It depends on where those cancellations and reinforcements are occurring in the audio spectrum. Before the Phazer, the only way to 'tune' the phase response would have been to move the mic around the studio until a sweet spot was found.

Next, insert the Phazer into the DI signal path. While mic placement is still very important, the Phazer gives you another approach. Instead of moving the mic around the studio to find the sweet spot, place it where it sounds good on its own then use the SHIFT control to tune the phase of the DI signal until it aligns with the mic in a way that sounds good to you.

Electric Guitar - Mic and Radial JDX Amp DI

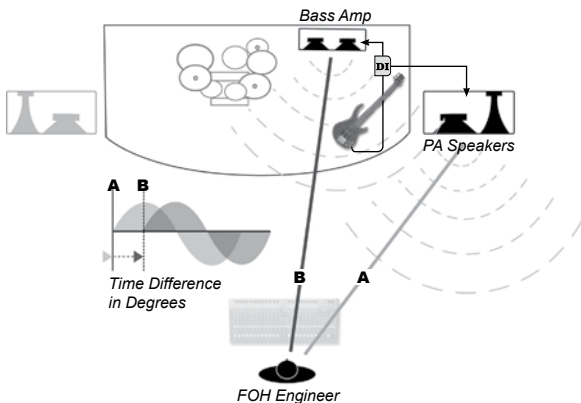
The magic of the Phazer is fully revealed when used with the Radial JDX amplifier DI. The JDX connects between your amplifier's output and your speaker cabinet. It taps and filters the direct sound of your amp then outputs a balanced mic-level signal to the mixing console. It taps and filters the direct sound of your amp then outputs a balanced mic-level signal to the mixing console.

Combining the JDX with a microphone can produce good results. The Phazer can take it to the next level by aligning the direct output of the JDX with the mic signal, allowing you to dial-in huge sounding guitar tones in a flash. This technique is of particular advantage to touring bands as it provides a consistent 'repeatable' guitar sound while reducing phase related problems.



Bass Guitar in a Live Venue

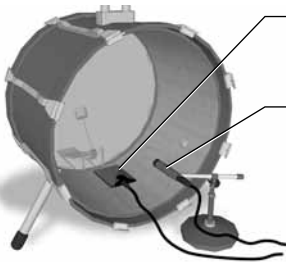
In a typical stage set up the bass guitar connects to a DI box to feed the PA system and the bass stage amp. Here's what happens. The sound from the bass is reproduced almost instantaneously by the bass-amp and PA speakers, but since the bass-amp is positioned at the back of the stage, several feet behind the PA speakers, the bass-amp sound will arrive at the mix position a few milliseconds AFTER the sound waves from the PA, causing a phase offset.



The resulting comb-filtering makes mixing the sound more difficult and the low-frequency definition from the bass may be lost for most listeners. As it is impossible to solve all of the phase problems in a room (due to reflections off walls and ceilings) the intent is to at least provide the mix position with the best sound possible so that the mix is balanced. This is where the Phazer comes in. By inserting the Phazer on the bass guitar signal going into the PA system, we can shift the phase so that the PA and bass amp play together in phase.

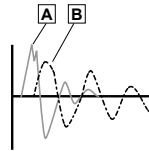
Kick Drum - a Better Beater Sound

Engineers often use two mics on a kick drum. The first mic (**A**), typically a condenser, is placed close to the drum head to pickup up the beater sound for added snap. A second mic (**B**), often a dynamic, is positioned further away to pickup the overall low frequency tone of the drum. The distance between the two mics creates a phase offset which the Phazer can compensate for. Insert the Phazer into the signal path of **Mic A** to time align the two mics for a tighter sounding track.

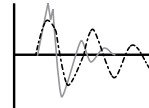


Mic A - placed close to beater head.

Mic B - placed outside drum shell.



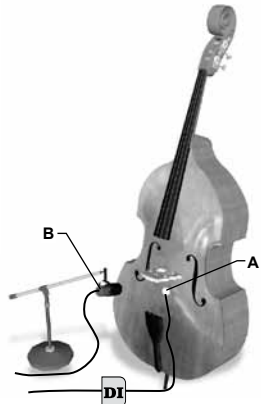
The two signals arrive at different times.



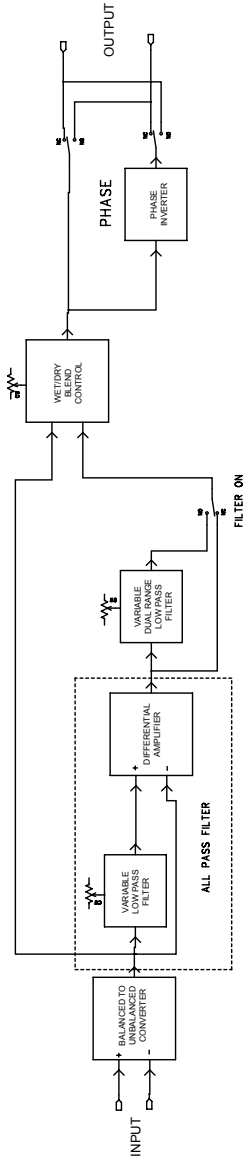
The Phazer aligns the signals for a bigger and tighter kick drum sound.

Upright Bass

Engineers often combine the signals from a piezo contact pickup (**A**) and a microphone (**B**) when recording an upright acoustic bass. The piezo's signal arrives instantaneously followed by the mic's signal a moment later. Shifting the piezo signal into alignment with the microphone will reinforce the fundamental creating a bigger and more natural bass sound.



Block Diagram



Specifications*

Circuit:	Class-A, 100% discrete components
Frequency response:	20Hz to 20kHz +/- 0.5dB
THD:	0.01 % from 20Hz to 20kHz
¼" Phone I/O:	TRS +4dB balanced TIP: hot (+) RING: cold (-); SLEEVE: ground
	TS -10dB unbalanced TIP: hot (+); SLEEVE: ground
XLR I/O:	+4dB balanced, PIN-1: ground PIN-2: hot (+) AES standard PIN-3: cold (-)
Input impedance:	10K Ohm
Output impedance:	600 Ohm balanced, 1K Ohm unbalanced
Ground Lift:	Lifts pin-1 on the XLR output
Phase Shift:	0° to 180° degree control Invert switch on: 181° to 360°
Low Pass Filter:	Variable from 300Hz to 3.8KHz and from 3KHz to 38KHz
Bypass:	True-bypass with sealed gold relay
Construction:	14-gauge steel chassis and outer shell. Durable powder coat
Size:	5.8"w x 3.8"d x 1.8"h (147mm x 96.5mm x 46mm)
Weight:	1.75 lb (0.82kg)
Warranty:	Radial 3-year, transferable
Power:	15VDC (400mA), center pole positive

* 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 center 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 center.

THERE ARE NO EXPRESSED WARRANTIES OTHER THAN THOSE ON THE FACE HEREOF AND DESCRIBED ABOVE. NO WARRANTIES WHETHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL EXTEND BEYOND THE RESPECTIVE WARRANTY PERIOD DESCRIBED ABOVE OF THREE YEARS. RADIAL SHALL NOT BE RESPONSIBLE OR LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSS ARISING FROM THE USE OF THIS PRODUCT. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS, WHICH MAY VARY DEPENDING ON WHERE YOU LIVE AND WHERE THE PRODUCT WAS PURCHASED.



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