



RPM-1

Vacuum-Tube Rotary Speaker Emulator

Safety Precautions



The symbols shown above are internationally accepted symbols that warn of potential hazards with electrical products. The lightning flash with arrow point in an equilateral triangle means that there are dangerous voltages present within the unit. The exclamation point in an equilateral triangle indicates that it is necessary for users to refer to the owner's manual.

These symbols warn that there are no user serviceable parts inside the unit. Do not open the unit. Do not attempt to service the unit yourself. Refer all servicing to qualified personnel. Opening the chassis for any reason will void the manufacturer's warranty. Do not get the unit wet. If liquid is spilled on the unit, shut it off immediately and take it to a dealer for service. Disconnect the unit during lightning storms or wind storms to prevent damage.

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The information contained in this manual is subject to change at any time without notification. Some information contained in this manual may also become inaccurate due to undocumented changes in the product since this version of the manual was completed. This manual supercedes all previous versions.
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US Patents 4,688,464, 5,231,671, 5,301,259 and 5,428,708;

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Power and Grounding Information:

The RPM-1 is equipped with a three-prong, grounded power cord for your protection. Do not cut off the ground prong of the plug, and do not use an adapter or extension cord to plug the unit into a two prong outlet unless the adapter or extension cord is properly grounded.

The RPM-1, like any piece of music hardware, is sensitive to voltage drops, spikes, and surges; interference such as lightning or power “brownouts” can permanently damage the circuitry inside the unit. Here are some suggestions to help protect your RPM-1 from such a fate:

- Turn it off: Make a habit of turning off all of your gear when it is not in use. If there is lightning or a severe windstorm, unplug all of your equipment: A surge from a nearby lightning strike or downed power line can destroy electronic equipment even if the switch is off.
- Spike/Surge Protectors: This is an inexpensive solution to all but the severest of AC line conditions. Surge protected power strips are usually slightly more expensive than unprotected strips, and higher quality multi-stage surge suppressors usually start under \$50, making them a worthwhile investment for protection of all your valuable electronic equipment.
- AC Line Conditioners: This is the best (but most expensive) way to protect your musical equipment from line voltage fluctuations. Line conditioners constantly monitor the incoming voltage for excessive peaks and dips and make adjustments accordingly, delivering consistent power levels. For expensive studio equipment, AC line conditioners are highly recommended.

Introduction:

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Thank you for purchasing the DigiTech RPM-1, a new effect that creates a classic sound.

When electric organs were first sold, their sound was static and needed some “animation”, so the rotating speaker cabinet was born. The rotating speaker sound became synonymous with blues, jazz and rock & roll, especially when players discovered that they could drive the cabinets’ built-in tube amplifiers into distortion and get a thick, warm sound as well as the swirling rotary effect. (See diagram, page 6)

The DigiTech RPM-1 allows you to emulate that classic rotating speaker sound without having to deal with the bulky speaker cabinets that were formerly required.

Based on extensive study of rotating speaker cabinets, the DigiTech RPM-1 incorporates *speaker emulation* circuitry which delivers an authentic sound by recreating the individual horn and cabinet resonances of a real rotating speaker.

There are several features of the DigiTech RPM-1 that make it unique:

- 1) Where competing products use solid-state distortion circuitry to simulate overdriven sounds, the DigiTech RPM-1 is unique in that it uses a vacuum tube analog distortion pre-amp. The 12AX7A pre-amp stage gives you the authentic, rich, warm overdriven sounds previously attainable only with actual rotating speaker cabinets.
- 2) Only the DigiTech RPM-1 gives you the flexibility to run mono, stereo, or tri-output mode to simulate the most effective microphone arrangements on stage or in the studio.
- 3) The DigiTech RPM-1 is a ruggedly built, 1U full rack-mount unit, with AC power. No external power supplies or flimsy plastic cases.
- 4) While other units are based on modified chorus or phase-shifting circuits, only the DigiTech RPM-1 incorporates patented Intelligent Pitch Shifting technology together with VLSI delay and volume modulation circuitry for maximum realism.

Front Panel

Power Switch

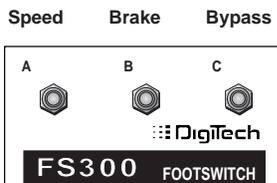
Turn on the RPM-1 before your mixer or amplifier, or turn down volume on mixer or amp if you are going to switch the RPM-1 on or off.

Input

Controls the input level to the RPM-1. Adjust this while playing so that the Clip indicator only flashes on the loudest musical peaks. Turning up the Drive control increases the pre-amp gain, and you may have to adjust the Input after setting the Drive. (See also page 4 for balancing Bypass)

Speed Switch

(also activated by the left footswitch button) Alternates between the slow and fast rotary speeds. The light will flash in time with the revolutions.



Brake (also activated by the center footswitch button) Stops the rotation portion of the effect, leaving the Drive and Cabinet Emulation effects in place. The Brake over-rides the speed control; turn off the Brake to return to the rotating sound. When the Brake is applied, the Horn and Rotor stop at a random position, like a real rotating speaker. By quickly dis-engaging and re-engaging the Brake, you can change the stopped position, to control the harmonic content of the stationary sound.

Bypass (also activated by the right footswitch button) Bypasses the RPM-1 effects so that the original "dry" signal is sent to all three outputs. The Bypass is full Stereo - Right and Left inputs remain separated while the RPM-1 is Bypassed.

Drive

Controls the amount of overdrive provided by the RPM-1's vacuum-tube pre-amp. The tone will change from clean in the fully counter-clockwise position, to a lightly compressed sound with a touch of distortion in the center, to a compressed, full-out overdrive "crunch" in the fully clockwise direction. You may have to adjust the Input after setting the Drive.

Horn speed

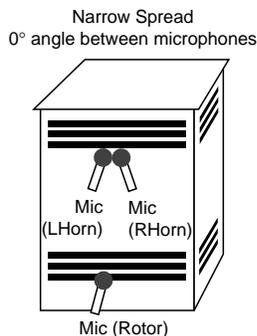
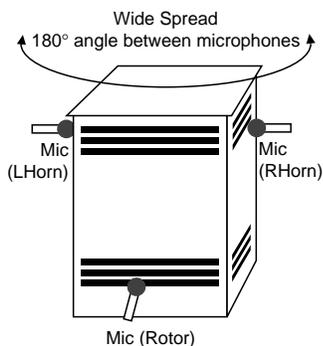
Sets the rotation speed of the horn (high frequency portion of the sound) in both the fast and slow Speed settings.

Rotor Acceleration

Because the low-frequency rotor in a rotating speaker cabinet is much larger than the horn, it takes longer to speed up and slow down than the horn does. The Rotor Acceleration control determines how fast the Rotor sound speeds up and slows down - clockwise makes the acceleration time shorter. In the fully counter-clockwise position, the Rotor sound does not turn at all.

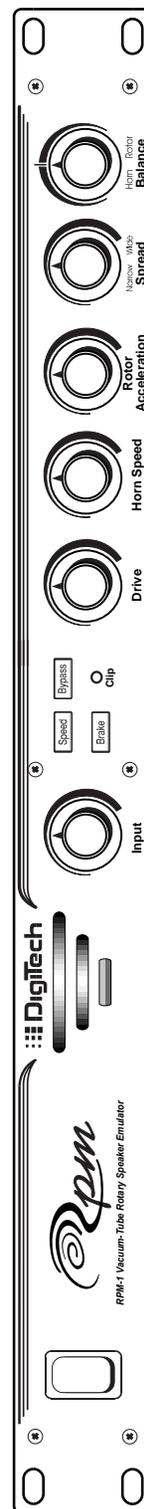
Spread

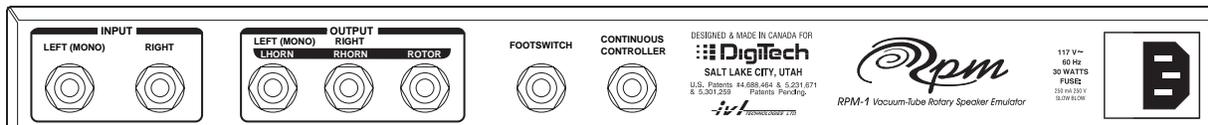
Emulates the position of two microphones around the rotary speaker cabinet. A fully wide spread setting corresponds to a 180° spacing of the mics (i.e. on either side of the cabinet), which gives the most dramatic stereo effect. A fully narrow setting emulates both mics being placed together giving a monaural sound. If you are using the RPM-1 with only the mono output, turn the control fully clockwise.



Balance

Adjusts the volume balance between the high frequency Horn sound and the low frequency Rotor sound. This can be used to adjust the frequency balance; counter-clockwise toward Horn is brighter, clockwise toward Rotor is darker.





Matching Bypass and Effect levels

When setting up your instrument volume and RPM-1 Input levels, use the Bypass button or the Bypass footswitch to alternate between the Bypass and Effect sounds while you are playing, and adjust the Input control until the two levels are equal.

If your instrument is outputting a very hot signal, the 12AX7A tube will be compressing and adding warmth to the signal even at minimum Drive settings. This may be desirable, unless you need to balance the Bypass level; in that case, you should turn the RPM-1 Input control up to maximum and then turn your instrument volume down to balance the levels.

Tri-Output mode

To use Tri-Output mode, leave the Horn/Rotor Balance control in the center position, and adjust the Spread control to maximum Wide position. Route the three outputs to three input channels on your mixer, pan the LHorn and RHorn outputs left and right and pan Rotor center.

This gives you the most flexibility by allowing you to EQ and balance the Left Horn, Right Horn and Rotor sounds independently. Try applying reverb to both Horn outputs while leaving the Rotor output dry.

Rear Panel

Stereo Inputs

Use Right and Left inputs for stereo, use one plug only in the Left input for mono.

Outputs

Use the Left output for mono, Left and Right for a stereo image of the rotating effect, and LHorn, RHorn and Rotor to simulate two microphones on the horn (high frequency) and one microphone on the Rotor (low frequency).

Footswitch

Stereo 1/4" phone jack for the DigiTech FS300 Footswitch (included)

Continuous Controller

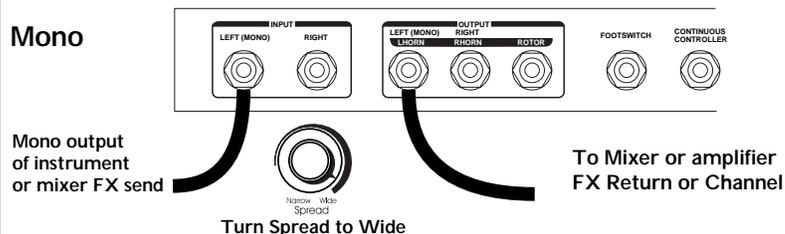
For an optional volume pedal - controls the rotor speed, overriding the Speed and Brake buttons when a pedal is plugged in.

This input will use most passive volume pedals or a 0-5 V control voltage pedal - plug a standard guitar cord between the pedal's output and the Continuous Controller jack.

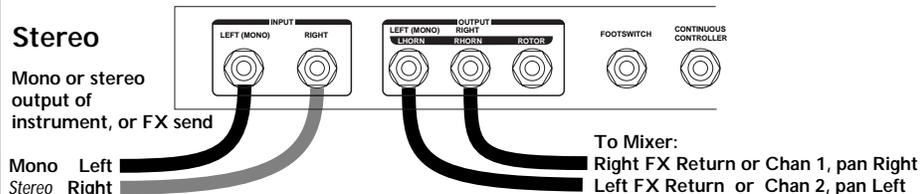
Plug the pedal in **before** you turn on the RPM-1, then immediately after turning on the RPM-1, sweep the pedal from its minimum to maximum position to calibrate the response.

Connection Diagrams

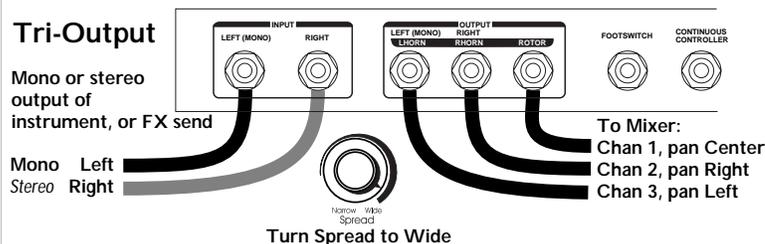
Mono



Stereo



Tri-Output





Performance Notes

Note

The RPM-1 contains a 12AX7A vacuum tube, which must be warm to run properly. Note the air vents on the front of the case. Make sure that these are never blocked, and ensure that no foreign object enters these vents.

Adjusting the Drive

The Drive control, Input control and the volume of your instrument all interact to create the distortion sound of the RPM-1. As you turn the Drive control from fully counter-clockwise towards the vertical position, you will notice the sound taking on a warmer or “furry” tone and the overall volume will increase somewhat. This may require an adjustment of the Input level. The exact point at which the distortion starts depends on the Input level and your instrument’s volume. Past the 12 o’clock position, the distortion becomes more aggressive.

When you play chords at high distortion levels, you may hear a rhythmic beating sound which is independent of the horn and rotor speed. This beating is the interference distortion sound caused by the interaction between two or more notes being played at the same time. Try playing single lines instead of chords, and you’ll notice that the beating drops off. If you prefer not to have this beating sound, reduce the Drive control.

Speed control

Organists have traditionally used the speeding up and slowing down of the rotating speakers to add emphasis and excitement to their playing. Usually, you would not leave the Fast Speed setting on continuously, but rather you would toggle the Fast speed on and off to emphasize peaks in your playing. The most interesting part of the rotary speaker sound occurs while the rotor and horn are accelerating and decelerating.

Brake

The Brake button will gradually bring the rotary effect to a complete stop from either the Fast or the Slow setting. This is useful when you don’t want the rotating effect, but do want the distortion and/or cabinet emulation to warm your sound up. You can change the Speed setting, but with the Brake on, there will be no rotating effect. When you disengage the Brake, the rotor and horn will then speed up to the current Speed setting again, based on the Rotor Acceleration control.

Footswitch

The RPM-1 comes with the DigiTech FS-300 footswitch, which has three switches on it. From left to right, the footswitches correspond to the RPM-1’s Speed, Brake and Bypass buttons.

Using the RPM-1 with Guitar

The RPM-1 faithfully emulates the rotor and horn resonances of a real cabinet, which can sound a bit bassy and dark if a guitar is connected directly to the input. It is best to run a guitar through a pre-amp or a guitar processor (such as the DigiTech GSP series), with the RPM-1 in the effects loop, or at the end of the audio chain like a real rotating speaker cabinet would be.

If you want to connect a guitar directly, you can use the Balance control like a tone control, more treble on the left (Horn) side, more bass on the right (Rotor) side.

For a clean, warm sound, keep the volume control on your guitar and the Input control up near their maximums and the Drive control around 10 to 12 o’clock.

Suggested Settings:

Use the following settings as a guide to achieving different effects. Keep in mind that different instruments may require slightly different settings, especially in the adjustment of the Drive control.

	Drive	Horn Speed	Rotor Accel.	Spread	Balance
Standard Organ					
Solo Organ					
Super Stereo FX					
“Tine” Electric Piano					
Synthesizer					

For tube-amp distortion for rhythm guitar, turn up the Drive control. This will give a warm distortion similar to classic tube amplifier / bass speaker cabinet combinations.

Keyboard sounds

The RPM-1 sounds great on a variety of keyboard sounds, especially when used on a mixer FX send so that you can blend the RPM-1 sound with the direct sound. A touch of distortion will enhance the realism of electric piano sounds, and the cabinet emulation simulates the built-in speakers of popular electric pianos. Sampled piano sounds through the RPM-1 with Drive at 11 o'clock, Horn Speed at 8 o'clock and Balance at about 1 o'clock can create a convincing "reed" electric piano. With Drive at 8 o'clock, and Balance closer to 12:00, you can get a compressed, bell-like piano sound. The cabinet emulation will round out and warm up any sound you put through it, so try the RPM-1 with the Brake engaged even when you don't want a rotating speaker effect. The cabinet emulation has a definite personality to its frequency response, so "realistic" sampled sounds and sounds with lots of high frequency content can be altered, sometimes dramatically. You can experiment with it; try doubling the RPM-1 sound with the straight sound, both for solo instruments and for pad sounds. Turn off any distortion, delay, chorusing or modulation in the instrument to feed the RPM-1 a clean sound.

Organ

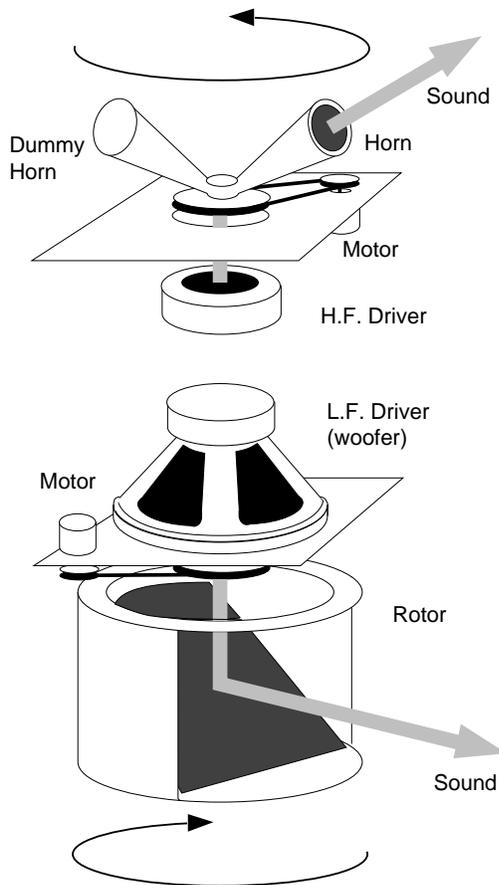
For best results, make sure that your organ sound input is as pure as possible. Whether you are using a combo organ, synthesizer, sound module or tone-wheel organ, turn off any distortion, delay, chorusing or modulation in the instrument. The best sound is achieved by letting the RPM-1 add the rotating speaker emulation to a clean organ sound. You can add reverb or delay with an external effects device placed after the RPM-1 in the audio chain, or through an effects send on your mixer.

Organists will often change the timbre of their sound by pushing in and pulling out the drawbars on their instrument while they are playing. This emphasizes certain frequencies of their sound over others. If you are not using an organ with drawbars, you can twist the RPM-1 Balance control to get a variation in tone while you are playing.

What is a rotary speaker?

A rotating speaker cabinet consists of a high frequency compression driver and a low frequency speaker, whose sound is directed through mechanical deflectors spun by motors. The motors can be switched between stop, slow and fast rotation speed.

The horn and the rotor create a directional beam of sound, and as they spin, this sound beam is swept around 360°. The sound is always moving in relation to the listener, creating pitch (Doppler) shifts, volume variation, and constantly changing, complex reflections from the inside of the cabinet and the surrounding objects.



Conceptual diagram of a rotating speaker cabinet. The components above would be housed in a large wooden cabinet.

Specifications

FCC Notice

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designated to provide reasonable protection against such interference in a residential installation.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment OFF and ON, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient the receiving antenna

Relocate this equipment with respect to the receiver

Move this equipment away from the receiver

Plug this equipment into a different outlet so that this equipment and the receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful:

"How to Identify and Resolve Radio/TV Interference Problems"

The booklet is available from the U.S. Government Printing Office, Washington, DC 20402, Stock # 004-000-00345-4

DigiTech RPM -1 Vacuum Tube Rotary Speaker Emulator

Input sensitivity	-10 dBu to + 4 dBu
Input impedance	470 kOhms
Maximum output level	+ 8 dBu
Output impedance	1.5 kOhms (max.)
Continuous Control CV in	Control Voltage 0 – 5 VDC; Passive - auto calibration
Dynamic range	> 90 dB IHF-A weighted
T.H.D. + N	< 0.1% IHF-A weighted, @ 1 kHz input
Dimensions	17.5" (W) x 5.5" (D) x 1.25" (H) (not including rack mount)
Weight	5 lbs
Power supply consumption	30 W
Power requirements	117 VAC 60 Hz
Tube Type	12AX7A

Over the course of time, the 12AX7A vacuum tube may wear and require replacement. Replace only with a tube of the same number, and refer installation to a service shop or dealer. Avoid dropping the RPM-1 or handling it roughly, as this could shorten the life of the tube.

Don't install the RPM-1 in an unventilated rack, and don't install directly above heat-producing equipment such as power amplifiers.

Note: Design and specifications are subject to change without notice.

Warranty

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1. The warranty registration card must be mailed within ten days after purchase date to validate this warranty.
2. DigiTech warrants this product, when used solely within the U.S., to be free from defects in materials and workmanship under normal use and service.
3. DigiTech liability under this warranty is limited to repairing or replacing defective materials that show evidence of defect, provided the product is returned to DigiTech WITH RETURN AUTHORIZATION, where all parts and labor will be covered up to a period of one year. A Return Authorization number may be obtained from DigiTech by telephone. The company shall not be liable for any consequential damage as a result of the product's use in any circuit or assembly.
4. Proof-of-purchase is considered to be the burden of the consumer
5. DigiTech reserves the right to make changes in design or make additions or improvements upon this product without incurring any obligation to install the same on products previously manufactured.
6. The foregoing is in lieu of all other warranties, express or implied, and DigiTech neither assumes nor authorizes any person to assume for it any obligation or liability in connection with the sale of this product. In no event shall DigiTech or its dealers be liable for special or consequential damages or from any delay in the performance of this warranty due to causes beyond their control.