RPA-1 HF Preamplifier

DXE-RPA-1

DXE-RPA-1-INS Rev 4a

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P.O. Box 1491 · Akron, OH 44309-1491
Phone: (800) 777-0703 · Tech Support and International: (330) 572-3200
Fax: (330) 572-3279 · E-mail: DXEngineering@DXEngineering.com

RoHS

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Introduction

The **DXE-RPA-1** is optimized for 0.3-35 MHz operating range. The push-pull amplifier design and robust components enable it to withstand high signal levels and operate when you need it most. The dynamic range of the **DXE-RPA-1** is better than most receivers.

The **DXE-RPA-1** metal housing provides shielding and improved lifespan. The unit uses parallel RCA type phono jacks and CATV F connectors for the input and output connections, and a relay that automatically bypasses the preamplifier when dc power is removed. You may use cables with either RCA or F connectors on both input and output.

The **DXE-RPA-1** is a high performance broadband LF and HF receiver preamplifier that features exceptional immunity to overload. It also has a low input SWR, and an excellent noise figure. The amplifier is constructed of quality components mounted on a sturdy, G-10 fiberglass circuit board. The circuit board mounts in an aluminum enclosure best suited for indoor use. RF connectors are RCA phono and F type CATV fittings. Performance is optimized for 350 kHz to 35 MHz, where dynamic range and third order intercept are typically more than 20 dB (one hundred times) better than conventional preamplifiers.

Features

- Push-pull operation eliminates harmonic distortion
- High quiescent current increases ability to handle strong signals without distortion or overload
- Meticulous craftsmanship and durable components provide superior dynamic range
- RCA type phono jacks and type F connectors ease installation
- Simplified switching - automatic bypass eliminates gain when dc power is off
- 12-18 Vdc power using power connector or through the coax
- 12-18 Vdc through coax enables remote operation at antenna

Additional Requirements

Please note you will need to consider the following requirements (parts not included in this package) to install and operate the **DXE-RPA-1** HF Preamplifier:

The **DXE-RPA-1** requires a well-filtered, negative ground, 12-18 Vdc @130 mA power source. Depending on the supply current, you might also need an inline fuse. Powering the **DXE-RPA-1** through the coax feedline requires a voltage injector circuit (not included) and an internal connection change.

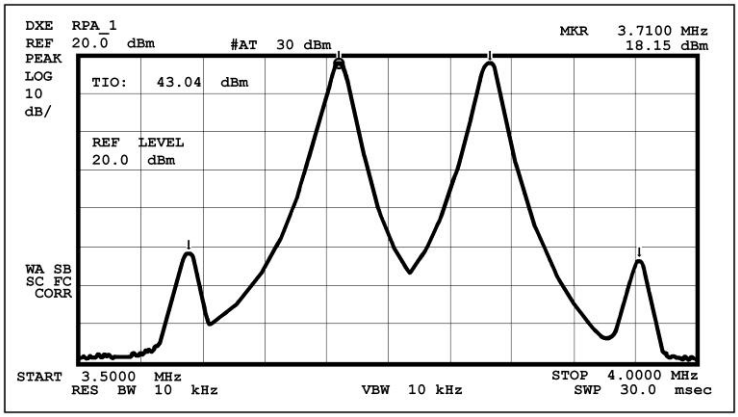
Installation outdoors at the antenna is not normally needed or recommended. However, some antenna types such as Pennants, Flags or K9AY Loops require a preamplifier at the antenna. If you are mounting the unit outdoors, you will also need a non-corrosive, silicon-based RTV sealant, such as DX Engineering **RTV598335**. Sealants that contain acetic acid are corrosive to aluminum and should be avoided.

Specifications

Power Requirement: 12-18 Vdc @ 130 mA maximum
Output TOI (Third Order Intercept): +43 dBm @ 13 Vdc
Noise figure: 3.5 dB
One dB Compression: +26 dBm (~ .4 watts output)
Gain: 16 dB from 300 kHz to 35 MHz (+1.5 to −1.5 dB over this range)
500 Hz BW IM3 Dynamic range: 110 dB or greater

The following are simplified explanations of information highlighted above.

Third Order Intercept



A standard measure of how well a receiving system performs in the presence of strong nearby signals. The higher the third order intercept (TOI), the less likely adjacent strong signals will cause interference. The **DXE-RPA-1** offers substantially improved TOI over competitive preamplifiers and communication receivers. The figure to the right illustrates a typical **DXE-RPA-1** output third order intercept measurement. The **DXE-RPA-1** is significantly more immune to overload than the best commercial amateur receivers. Third order products are 50 dB below +18 dBm output.

Noise Figure

The ratio of equivalent noise power developed at the input to that generated by thermal noise in the source resistance, usually expressed in decibels. If it were possible, a perfect amplifier would have a noise figure of 0 dB. The **DXE-RPA-1** is extremely quiet, and does not contribute noticeable noise to receiving systems.

Dynamic range

The ratio of the faintest signal detected to the loudest signal amplified without significant distortion, typically expressed in decibels. The **DXE-RPA-1** allows you to hear faint signals in the presence of adjacent strong signals.

Gain

The ratio of signal input to output. The **DXE-RPA-1** features a high gain that is easily reduced if not needed.

Installation

Mounting

Optimum electrical location of the **DXE-RPA-1** varies with antenna system background noise level. A good receiving system requires the antenna to establish system noise, rather than amplifying devices. One common myth is that preamplifiers must be mounted at or near antennas to be effective. This is not true at VHF and lower frequencies, unless feedline loss is high and the antenna has very low background noise. Another common misconception is that mounting at the antenna feedpoint reduces feedline noise pickup. The location of the amplifier rarely makes a difference in feedline noise. Most feedline noise couples back to the antenna at the antenna terminals, it does not leak directly into the feedline.

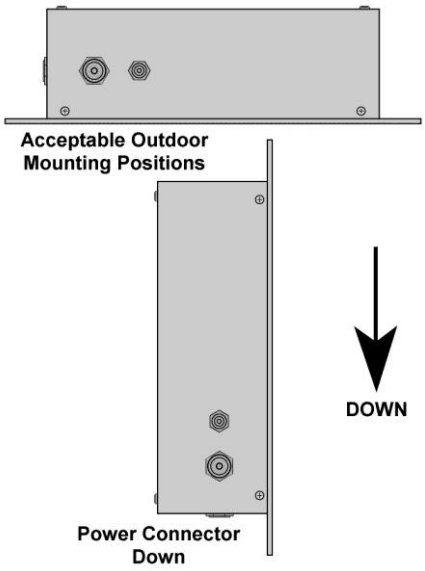


Figure 1

For best results, mount the **DXE-RPA-1** in a well-ventilated area indoors away from direct sunlight and moisture. Constant operation in ambient temperatures above 150°F (65°C) will shorten the life of the **DXE-RPA-1**, and should be avoided.

It is acceptable to mount the unit outdoors if the upper seams of the box are sealed with an outdoor silicon RTV sealant or coax seal. Lower gaps or seams must be left open to allow condensation drainage. Mount the flanges of the box flat against a horizontal surface, or with the two mounting flanges positioned in a vertical line as shown in **Figure 1**.

Warning: Never transmit through RPA-1. The unit can be damaged by direct application of transmitter power greater than 1 watt.

Mounting at the Antenna

Ordinarily, the preamplifier should be mounted indoors at the operating position, rather than at the antenna. There are a few exceptions, however, including:

- **Pennants, Flags, and K9AY Loops in quiet locations.** These antennas have relatively low sensitivity or gain. When used in quiet locations, they do not provide much background noise to the system. If the feedline loss is high, performance might improve with the preamplifier mounted near the antenna.
- **Small loops (magnetic loops).** These antennas also lack sensitivity, and may require mounting the amplifier near the antenna when cable runs are lossy.

Determining Sensitivity

The following is a simple method to confirm adequate sensitivity. This test generally requires the assistance of another operator:

1. Listen at the quietest expected operating time with the receiver set to its narrowest selectivity.
2. Remove all receiving antennas from all feedlines.

3. Replace the antennas with a resistor load of the same impedance as the antennas.
4. When the load is substituted for the antenna, a noticeable decrease in noise should occur.

It is advantageous to have receiver AGC action begin just above noise floor, while avoiding excessive levels of background noise. This usually occurs when there is a perceptible increase in S meter reading, when the antenna is connected. If background noise is high or your receiver is overloaded, you can add an attenuator pad or remove power from the **DXE-RPA-1**. Removing power bypasses the **DXE-RPA-1**.

Connecting the Power Supply

The **DXE-RPA-1** requires a well-filtered 12-18 Vdc @ 130 mA source with a negative ground. Many inexpensive wall mounted transformer DC supplies are not 'clean' and have RF noise components on their DC output. Place the fuse at the power supply, rather than at the **DXE-RPA-1**.

The **DXE-RPA-1** power connector uses a standard 2.1 mm barrel type plug (included). You can use a well regulated +13.8 Vdc supply provided it supplies 12-18 Vdc negative ground (has the power plug shell connected to negative) and has an inline 1A fuse.

WARNING! *Be sure the supply polarity and voltage are correct.*

Powering Through the Coaxial Cable

The external power connector is normally active, but components are inside the **DXE-RPA-1** to allow powering through the coaxial feedline. To change the power feed, refer to **Figure 2** and do the following:

1. Unsolder RFC1 - 100 uH RF choke lead that connects to the power jack.
2. Connect the free choke lead to the PC board indicated by the RFC1 choke outline.

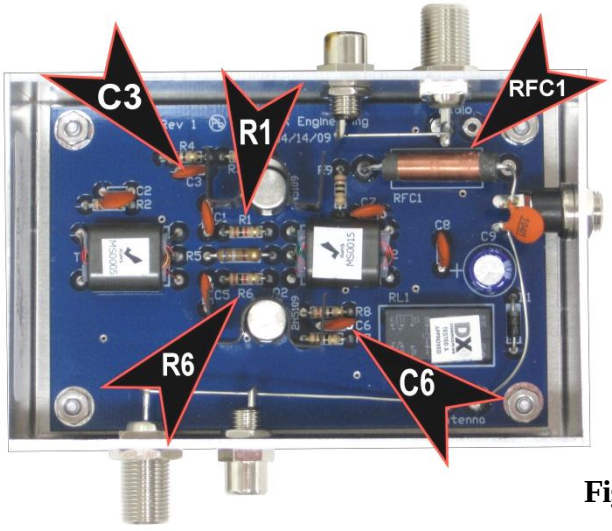


Figure 2

Caution: ***Do not nick, scratch, or break the fine wires on the RFC1 choke. Do not grab the RFC1 choke body with pliers.***

NOTE: *A 12-18 Vdc low noise positive power source must be inserted in the feedline center conductor through a feedline voltage injector and the voltage must be blocked from appearing at the receiver.*

Reducing Gain

If signals are overloading your receiver or if background noise is excessively high, there are two solutions. The first solution involves adding a conventional attenuator pad either leading or following the **DXE-RPA-1**. Addition of a pad on the input will reduce noise figure roughly by the amount of the attenuation. This is usually not a problem with modest antenna efficiency. At the same time noise figure decreases, input intercept (overload limits) will increase. Addition of an attenuator pad on the **DXE-RPA-1** output reduces output intercept. Input intercept and noise figure remain essentially unchanged.

As a general rule, reduction of gain with a pad at either spot will not compromise system performance. This is because the **DXE-RPA-1** design has a very large performance margin in both noise figure and intercept. You can also reduce gain about 3 dB, from 17 to 14 dB, by cutting one lead of **C3** ***and*** **C6**. Since this is a push-pull circuit, both capacitors must be removed.(See **Figure 2**). If additional gain reduction is still necessary, solder a 1,500 ohm 1/4 watt resistor in parallel with R1 ***and*** another resistor of the same value in parallel with R6 to reduce the gain to 10 dB. Be aware internal gain reduction modifications will cause the upper frequency performance to fall at approximately 15 MHz or higher.

Maintenance

The **DXE-RPA-1** requires virtually no maintenance as long as the unit is not exposed to direct sunlight, moisture, or extreme temperatures. But as with any electrical device, lightning is a concern.

Lightning

While most amateur radio installations rarely suffer damage from lightning (even though they never disconnect their equipment); the best protection is to disconnect electrical devices during storms. The key to proper lightning survival is proper grounding of feedlines and equipment, and maintaining integrity of shield connections. A proper installation improves lightning protection and enhances weak-signal receiving performance. The **DXE-RLP-75FF** Lightning Protector, 75 ohm, DC Pass, Type F Connectors is one optional device that could be used. Consult lightning protection and station grounding information in the ARRL handbooks, the National Association of Broadcasters (NAB) handbook or other reliable sources.

Optional Items

DXE-F6 - 75 ohm F-6 Style, Direct Bury Coaxial Cable - Full Spool or Custom Cable Assemblies

DX Engineering recommends using a high quality 75 Ω "flooded" F6 type coaxial cable. Flooded style cables have the distinct advantage of automatically sealing small accidental cuts or lacerations of the jacket. Flooding also prevents shield contamination and can be direct-buried. This low-loss cable features dual shields and an 85% Velocity Factor.

Custom cable assemblies are available, Call DX Engineering for details.

DXE-SNS6 Snap-N-Seal connectors are recommended for use with this coaxial cable to ensure a high quality and weather resistant feedline connection. The proper tool **DXE-SNS-CT1** must be used to install these connectors.

DXE-CPT-659 - Coax Cable Stripper for CATV F-6, RG-6 and RG-59 coaxial cable.

Coax Cable Stripper for CATV F-6, RG-6 and RG-59 coaxial cable. Includes 1 Replacement Blade - DXE-CPT-659. Prepares CATV F-6, RG-6 and RG-59 coaxial cable for the installation of an "F" type connector - One-step cutting motion. Precision cut . No nicks or scratches to conductor

DXE-SNS-CT1 - Compression Tool for Snap-N-Seal 75 ohm Coaxial Connectors
Ratchet compression tool for installing **DXE-SNS6** Snap-N-Seal coaxial connectors. Ordinary pliers will not install these connectors properly.

DXE-SNS6-25 - Watertight Coaxial Connector, Snap-N-Seal for CATV F-6 Cable, 25 pieces
Snap-N-Seal is an environmentally sealed CATV F coaxial connector system for harsh environments. The connectors have a unique, 360 degree radial compression system that offers the signal leakage protection required for high performance receive systems.

- Quad sealed system prevents moisture from migrating into the connection
- 360 degree radial compression provides superior RF integrity (-95 dB typical, 60% bonded foil cable)
- Easy cable preparation
- Connector to cable retention of 40 lbs minimum
- Superb impedance match to 1 GHz
- Manufactured of high quality 360 brass, cadmium plated with yellow chromate coating for maximum corrosion resistance
- UV-resistant plastic and O-rings provide a reliable environmentally sealed connector

An installation tool, such as the **DXE-SNS-CT1** is required to install the connectors. Normal crimping tools or pliers will not work.

DXE-CIT-1 - F Connector Tightening Tool
The CIT-1 installs and removes F connectors in high density and hard to reach locations, and is the only tool that works with bent coax. Only finger force is required. Provides enough leverage to achieve a 30 in/lb tightening force by hand. Helps insure proper connections thereby reducing the potential of loose connector related service calls.

DXE-RTV598335 - Permatex® Black RTV Sealant, Non-Acetic - 3.3 oz Tube, Black DX Engineering Approved RTV Sealant By Permatex®. We have all used RTV to seal water out of things, right? Have you ever sealed a piece of electronic gear with it -- then opened it some time later to find that it had still managed to become corroded inside? Guess what? It's not the rain that corroded it - It's the RTV! Normal RTV gives off acetic acid when it cures. That's the vinegar smell. The acetic acid causes the corrosion. DX Engineering has located a Neutral Cure RTV made right here in Ohio that is non-corrosive and is safe for sealing those baluns and other electronic gear that are going to be out in the weather. Applies just like "normal" RTV, dries in one hour and cures in 24 hours at 70 degrees F. And it doesn't smell like vinegar!

- 3.3 oz. Tube, Black *This part is classified hazardous and is limited to domestic UPS Ground shipping only

DXE-22058 - Permatex® Dielectric grease, 3 oz.
Dielectric grease is ideal for keeping moisture from entering your coaxial connectors. It also acts as a lubricant allowing easy connector removal by stopping corrosion of electrical connectors. Multi-use 3 oz package.
Safe for all RF connections.

DXE-RLP-75FF - Lightning Protector, Receive 75Ω, DC Pass, F Conn
Unique In-Line® design is impedance matched to 75Ω and is virtually transparent to all analog or digital bi-directional signals from DC to 1.0 GHz. Tii's patented proprietary coaxial gas tube surge protector is equipped with an integral fail short mechanism for a power-cross condition which shunts both the coaxial cable's center conductor and sheath for a common path to ground. The DC breakdown voltage of the protector provides superior protection against transient surges, yet is compatible with network powered applications. The protection element is designed to reset after each over voltage event. Metallic housing of the Tii In-Line® Coaxial Lightning Surge Protector provides necessary EMI shielding. When properly connected the protector is environmentally sealed (15 psi) to prevent ingress of moisture and humidity encountered in broadband pedestals, vaults, NIDs and stand alone applications. Full 360˚ "F" port connectors provide superior RF performance and tighter connections

DXE-UT-KITF - F-Connector Coaxial Cable Prep Tool Kit
This cost-saving kit provides a handsome, convenient carrying case complete with the DX Engineering F-6 coaxial cable prep tools and accessories. It features a rugged, lockable enclosure fitted with a precut foam insert with a home for each tool.
The **DXE-UT-KITF** kit provides the case complete with the following:
DXE-CPT-659- Stripping Tool for RG-59/F-6 size cable w/extra blades
DXE-SNS6-25 - Snap-N-Seal Watertight F Connectors - qty. 25 pcs
DXE-SNS-CT1 - SNS Connector Compression Tool
CNL-911 - Coaxial Cable Shears
DXE-CIT-1 - F Connector Tightening Tool

This unit is RoHS (Reduction of Hazardous Substances) compliant. The components, including the solder used are all lead free. If you decide to do any modifications or internal repairs, you should use only lead free solder and lead free soldering tools. Lead free solder melts approximately 100 degrees higher than the old leaded solder, so you may need to upgrade your current soldering system.

Technical Support

If you have questions about this product, or if you experience difficulties during the installation, contact DX Engineering at (330) 572-3200. You can also e-mail us at:

DXEngineering@DXEngineering.com

For best service, please take a few minutes to review this manual before you call.

Warranty

All products manufactured by DX Engineering are warranted to be free from defects in material and workmanship for a period of one (1) year from date of shipment. DX Engineering's sole obligation under these warranties shall be to issue credit, repair or replace any item or part thereof which is proved to be other than as warranted; no allowance shall be made for any labor charges of Buyer for replacement of parts, adjustment or repairs, or any other work, unless such charges are authorized in advance by DX Engineering. If DX Engineering's products are claimed to be defective in material or workmanship, DX Engineering shall, upon prompt notice thereof, issue shipping instructions for return to DX Engineering (transportation-charges prepaid by Buyer). Every such claim for breach of these warranties shall be deemed to be waived by Buyer unless made in writing. The above warranties shall not extend to any products or parts thereof which have been subjected to any misuse or neglect, damaged by accident, rendered defective by reason of improper installation, damaged from severe weather including floods, or abnormal environmental conditions such as prolonged exposure to corrosives or power surges, or by the performance of repairs or alterations outside of our plant, and shall not apply to any goods or parts thereof furnished by Buyer or acquired from others at Buyer's specifications. In addition, DX Engineering's warranties do not extend to other equipment and parts manufactured by others except to the extent of the original manufacturer's warranty to DX Engineering. The obligations under the foregoing warranties are limited to the precise terms thereof. These warranties provide exclusive remedies, expressly in lieu of all other remedies including claims for special or consequential damages. SELLER NEITHER MAKES NOR ASSUMES ANY OTHER WARRANTY WHATSOEVER, WHETHER EXPRESS, STATUTORY, OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS, AND NO PERSON IS AUTHORIZED TO ASSUME FOR DX ENGINEERING ANY OBLIGATION OR LIABILITY NOT STRICTLY IN ACCORDANCE WITH THE FOREGOING.

Specifications subject to change without notice.