Receive Antenna Interface for Transceivers

DXE-RTR-1A

U.S. Patent 8,175,546

DXE-RTR-1A-INS Revision 2c

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RoHS
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Introduction

The patented* DXE-RTR-1A Receive Antenna Interface for Transceivers is a unique and simple, multi-purpose relay unit which automatically switches the RF output antenna connector on any HF transceiver between a receiving antenna system and a standard transmitting antenna. A manual override switch allows instantaneous switching between transmit and receive antennas. The RTR-1A Receive Transmit Relay system operates from a "Transmit on Ground" keying line.

Designed specifically for HF transceivers which do not have a receive antenna input, the DXE-RTR-1A enables operators to safely enjoy the improved reception of a low noise receiving antenna system. This shielded relay system provides a safe method of connecting a receive antenna, such as a Beverage, Active Receive system, or other receiving accessories to your radio. The RTR-1A features a patented* receive antenna limiter circuit, with an RF limiting threshold at approximately two volts peak, that pass as normal level signals without affecting receiver IMD.

The RTR-1A is useful device for many applications, including:

- Connection of external receiving antennas to transceivers lacking external antenna ports
- T-R antenna switch for older equipment using separate transmitters and receivers
- Interfacing antennas to phasing or noise cancelling systems
- Addition of a Receive Preamp
- Excellent failsafe receiver protection for close-spaced antennas without the performance degradation of typical cheap back-to-back diode circuits

(* U.S. Patent Number: 8,175,546)

“An Amateur Radio Dilemma”

The benefits of using separate receiving antennas for “low-band” HF operations have been known for many years. Enthusiasts of operations below 14 MHz have learned that typical transmitting antennas collect too much noise for reception, especially for DXing on the 160 and 80 meter bands.

Unfortunately, for over three decades, only the most expensive HF transceivers have been manufactured with a separate receive antenna input. Even so, many older and newer “high-end” radios do not provide for switching their reception between a receive antenna and the default transmit antenna, nor do they interrupt the receive input during transmit. To obtain a separate receive antenna input, certain models required optional equipment or modules which are no longer available.

For many Amateur Radio Operators, the joy of low-noise, low-band reception with a separate receive antenna has been out of reach. Modern, “affordable” HF transceivers have been designed without any provision for a receive antenna connection. Otherwise very capable transceivers, even brand new models, lack a built-in receive antenna port and relay system.
The DX Engineering Solution

The **DXE-RTR-1A** Receive Antenna Interface for Transceivers, offers a special antenna switching solution, that incorporates safeguards against accidental RF transmission into a receive antenna system. The **DXE-RTR-1A** may be used for switching flexibility and to protect the receiver input during transmit for those transceivers that are so equipped.

Typical homebrew and commercial transmit/receive (T/R) relays, and other receive switching solutions on the market, offer little or no protection to the receive antenna equipment. Transmitted energy could damage receiving equipment if keying and timing errors or power loss occurs.

The **DXE-RTR-1A** is a new HF relay system that allows reception only if the unit is powered and the keying line from the transceiver is connected. As soon as the transceiver is keyed or the **DXE-RTR-1A** loses power at any time, the RF output from the transceiver is automatically diverted to the transmit antenna connection. A very fast acting (about 4 ms) 200 watt RF capable relay in the **DXE-RTR-1A** diverts the transceiver output quickly enough for QSK operation (full break-in CW) while listening to a receive antenna. The **DXE-RTR-1A** also allows instantaneous receive comparisons between the receive antenna and the transmit antenna, with a convenient three-position front panel switch. Indicator LEDs (Light Emitting Diodes) on the front panel allow the user to determine at a glance if the unit is properly powered and if the receive or transmit antenna is selected for reception and when the unit is keyed for transmission.

**Features**

- Attractive, Heavy Stainless Steel Enclosure that won't slide on your desk
- Front Panel LED Status Indicators and Manual Override Switch
- 200 Watt Transmit Switching Capability
- Supports CW full break in (QSK)
- Receive Antenna Inputs and Outputs use RCA phono and Type F connectors for safety
- Main Antenna and Radio Connectors are SO-239 for ease of installation
- Safe switching - automatically connects radio to transmit antenna when dc power is off
- Hot switching lockout – disconnects receive antenna during transmit mode
- Adds protection and antenna switching flexibility - for transceivers with receive ports
- Level Limiter helps to protect receiver front end from overload due to strong received signals
- RoHS compliant assembly

The **DXE-RTR-1A** Receive Antenna Interface for Transceivers is an attractive station accessory, housed in a heavy, stainless-steel enclosure which matches other DX Engineering station accessories. Cable connections to the **DXE-RTR-1A** are made entirely on the back panel, and all switches and indicators are on the front panel, for a clean, easy-to-use installation.
General Information

The **DXE-RTR-1A** Receive Antenna Interface for Transceivers is the accessory that allows owners of transceivers which lack a receive antenna input to safely enjoy optional receive enhancing equipment. The DX Engineering **DXE-RPA-1** Receive Pre-Amplifier may be used in-line on a receive antenna. The **DXE-NCC-1** Receive Antenna Variable Phasing Unit and the **DXE-AAPS3-1P** Active Antenna Phasing System are now available for operations for RX ANT Input deprived radios. The **DXE-RTR-1A** may be combined with the **DXE-TVSU-1A** Time Variable Sequence Unit for high power operations at stations where the receive antenna is physically close to the transmit antenna and for status indication of keying.

Old and new transceivers alike can benefit from the use of a high performance, low-noise pre-amplifier to enhance reception. The **DXE-RPA-1** Receive Pre-Amplifier offers dynamic range and third order intercept performance that exceeds most top dollar transceivers. As requested by many Amateurs worldwide, the receive only **DXE-RPA-1** Receive Pre-Amplifier may now be used in-line safely for improved reception with a transmitting antenna, when connected with the **DXE-RTR-1A**.

For enthusiasts who wish to use a favorite transceiver as a receiver only, now using an RF output connection to a receive pre-amplifier and antenna and can be virtually worry free. Accidental transmission through the receive antenna or receive pre-amplifier need not cause concern with a properly connected **DXE-RTR-1A**.

Many owners of transceivers that have receive ports are choosing to use the **DXE-RTR-1A**. For these operators it offers three benefits. First and foremost, the **DXE-RTR-1A** can protect the front end of the transceiver with automatic disconnection of the receive input during transmit, preserving fast CW break-in operation (QSK) with a 4 ms response time. Second, the **DXE-RTR-1A** offers a simple and handy way to toggle between listening to receive and transmit antennas with a front panel switch.

Third, the **DXE-RTR-1A** has a built-in Level Limiter circuit to help protect your receiver from damage due to strong received signals.

Most high-end transceivers, old and new, offer a receive antenna input that DOES NOT interrupt RF or switch off during transmit, even though the receiver is muted, very quickly in full break-in CW operation. This is a design feature which allows an operator to listen to a receive antenna, located a sufficient distance away from the transmit antenna to prevent receiver front end damage, allowing very fast QSK operations. However, most Amateurs who own this type of radio do not have access to the real estate for the required antenna separation to support this type of operation. Unfortunately, several hams have discovered these facts the hard way, after unintentionally blowing the front end of their expensive transceiver with transmitted RF riding in on their receive antenna feedline. Also, on many transceivers, connection of a receive antenna to the RX (antenna) IN port requires removal of the “RX OUT to RX IN” jumper patch cable, and then the transmit antenna cannot be heard. Recommendations for external relays and other devices have not addressed the need for protection as well as switching options. The **DXE-RTR-1A** fills this need with an attractive and versatile accessory.
For those who want to use a separate receiver or use a second transceiver as a receiver and interrupt the receive antenna feedline when transmitting, the **DXE-RTR-1A** may be used as a T/R relay. Also, monitoring the transmitting antenna with a second receiver while operating the main transceiver with a receive antenna (SO2R application) is possible with the **DXE-RTR-1A**.

The **DXE-RTR-1A** may also be used with an optional **DXE-RSC-2** Two-Port Splitter/Combiner to share a transmit antenna between two transceivers, with only one used for transmitting, or between a transceiver and a receiver.

Standard relays and coaxial relays that are used in a typical default receive T/R system are prone to keying timing problems which can result in damaging receiver front-ends due to pulses or hot switching. The **DXE-RTR-1A** solves that problem for vintage radio collectors and operators. Used as a traditional T/R relay, it switches a transmit antenna between a receiver and a transmitter with an output of up to 200 watts. The **DXE-RTR-1A** offers complete protection and high speed (4 ms) receive to transmit transfer. The **DXE-RTR-1A** is a superior solution to old, slow T/R relays, and it allows the safe use of an optional receive preamplifier.

Detailed diagrams of the following applications and accessory connections are included in this manual.

Connecting a transceiver that does not have a receive antenna input to:
- **DXE-ARAV3-1P** Active Receive Antenna
- **DXE-ARAV3-1P** Active Receive Antenna and transmit Antenna using high power
- **DXE-NCC-1** Receive Antenna Variable Phasing Controller with two **DXE-ARAV3-1P** Active Receive Antennas
- **DXE-NCC-1** Receive Antenna Variable Phasing Controller with two **DXE-ARAV3-1P** Active Receive antennas using high power to the transmit antenna.
- Single transmit antenna system using a **DXE-RPA-1** Preamplifier
- Single transmit antenna system using a **DXE-RBS-1** Reversible Beverage Antenna System
- Single transmit antenna with a **DXE-RFS-TS2P** Receive Four Square Array Package
- One DX Engineering Monoband or Multi-band Vertical transmit antenna using a **DXE-ARAV3-1P** Active Receive Antenna with the **DXE-NCC-1** Receive Antenna Variable Phasing Controller

Connecting a transceiver that has a receive antenna input and receive output:
- For any receive antenna system interruption of receive antenna feedline during transmit
- For the versatility of switching between listening to either the receive or transmit antenna

Connecting a transmitter and receiver to the same antenna system:
- Classic T/R relay connections for separate Transmitter and Receiver with a Single Transmit Antenna System using a **DXE-RPA-1** Preamplifier

Connecting two transceivers, one used for receive only, to the same transmit antenna, for simultaneous reception:
- Using an optional **DXE-RSC-2** Two-Port Splitter/Combiner, a transmit antenna can be shared for dual receiving.
Connecting two transceivers, one used for receive only, to the same active receive antenna, for simultaneous reception.

- Using an optional **DXE-RSC-2** Two-Port Splitter/Combiner, a transmit antenna can be shared for dual receiving.

Other uses of the **DXE-RTR-1A** are possible but not detailed in this manual:

- Connecting a non-active receive only antenna to a transceiver and transmitting antenna system
- Connecting a main transceiver and a second transceiver for single operator-two radio (SO2R) contesting.

Given the nature of Amateur Radio Operators and their interest in experimentation, there may be many other options available when using the **DXE-RTR-1A** Receive Antenna Interface for Transceivers.
DXE-RTR-1A  Receive Antenna Interface for Transceivers - Front Panel

1  **PWR ON-OFF**
Toggle Switch - DXE-RTR-1A power on and off. +12 Vdc power is supplied via the rear panel center positive connector.

2  **RX ANT - ACTIVE** indicator
One Red LED (Light Emitting Diode) illuminates to indicate the DXE-RTR-1A is in the receive mode. This LED extinguishes when MAIN ON is selected or when keyed with RX ANT selected.

When the power is off, a slight flickering or minor illumination of the LEDs indicates the receive limiter system is functional. A moderately illuminated LED warns of a potential receive antenna system to transmit antenna proximity problem or receive antenna input overload. Regardless of the power switch setting or the state of external power supply lines, any illumination of the Green LED indicates the limiter system is clamping or is ready to provide clamping. When fully illuminated, clamping is hard at approximately 2 volts peak.

3  **PWR** indicator
One Green LED (Light Emitting Diode) illuminates to indicate the DXE-RTR-1A is powered and turned on.

4  **MAIN ON - RX ANT - MAIN ON** toggle switch
Three position (On-On-plus Momentary) provides manual control of the DXE-RTR-1A antenna selections.

**MAIN ON** (up) - Manually switches RADIO to the MAIN ANT for receiving with the transmitting antenna. RADIO remains connected to MAIN ANT during transmit.

**RX ANT** (center) - Switches the RADIO to the RX ANT for receive mode and allows automatic switching of the RADIO to the MAIN ANT during transmit.

**MAIN ON** (momentary on when pressed down) - Manually switches RADIO to MAIN ANT momentarily for a fast check of reception on the transmitting MAIN ANT.
DXE-RTR-1A Receive Antenna Interface for Transceivers - Rear Panel

1 TRANSMIT GROUND
Isolated RCA connector - Keying line connection from transceiver or sequencer ( grounding keying line only) for automatic relay switching of RADIO from the RX ANT IN to the MAIN ANT. This connection to the transceiver is required to enable reception on a receive antenna; RX ANT through to RADIO with front panel MAIN ON/RX ANT switch in RX ANT position.

See Transmit Ground Line Function and Troubleshooting section below for more information.

Note: If the keying line is shared (using a "Y" adapter) with an amplifier or amplifier interface buffer, then precautions should be taken to be certain that the transceiver to DXE-RTR-1A connection is not interrupted.

If the keying line connection from the transceiver to the TRANSMIT GROUND connector on the DXE-RTR-1A is lost, transmitted RF may cause damage to the DXE-RTR-1A or receiving equipment.

This connector MUST be connected to the grounded-on-transmit transceiver keying line, cable shield to radio chassis ground, and the RADIO connector must be connected to the transceiver RF connector, cable shield to radio chassis ground, to enable receive mode.

Positive voltage keying will not key the DXE-RTR-1A properly.

Damage to the DXE-RTR-1A could occur by attempting to use positive voltage keying. Review your transceiver operation manual carefully. Transceivers with positive keying only must be connected to an interface buffer to provide grounding-on-transmit keying.
2 RADIO
SO-239 connector - Transmit and receive RF connection to the transceiver or connection to transmitter RF connector. Maximum 200 Watts transmit with MAIN ANT connected to a suitable antenna or load. Connected, by default, to the MAIN ANT IN connector when the DXE-RTR-1A is not powered or the MAIN ANT/RX ANT switch in the MAIN ANT position.

3 MAIN ANT IN
SO-239 connector - RF connection to a suitable transmit antenna or load. Connected, by default, to the RADIO connector when the DXE-RTR-1A is not powered or the MAIN ANT/RX ANT switch in the MAIN ANT position. Connection for high end transceiver "RX OUT" to monitor transmit antenna through DXE-RTR-1A. Details in Diagram 1B and text. While compatible with high power amateur radio stations, the RTR-1A can never be connected to the output of a high power amplifier. The MAIN ANT IN port must always connect to the input of any external amplifier or directly to the transmitting antenna system path if no amplifier is in use.

4 MAIN ANT OUT
RCA type connector and F-Connector (in parallel) - Output for special applications, receive only connection of MAIN ANT during receive mode only. Used for transmit antenna monitoring and pre-amplification or phasing purposes only. Disconnected during transmit or when unit is switched to MAIN ANT. This port is not level limited. This port is active only in the RX ANT receive mode, when power is applied and the “RX ANT ACTIVE” Red LED is fully illuminated. See Diagrams 5 and 8.

5 RX ANT IN
RCA type connector and F-Connector (in parallel) - Input for receive only antenna, or from a receive only device. May accept output from a DXE-RPA-1 Receive Preamplifier, or from a DXE-NCC-1 Receive Antenna Variable Phasing Controller. See Receive Antenna Input Limiter section below for more information.

6 12 VDC
A 2.1 mm power cord is supplied with unit. The wire with the white stripes is the +12 Vdc.

![Diagram of 12 VDC connection](image)

If station power is used, it must be +12 Vdc at 1 amp (fused) minimum. An optional DXE-PSW-12D1A 120 Vac 60 Hz to 12 Vdc 1 Amp, fused wall transformer supply is available.
Transmit Ground Line Function and Troubleshooting

The Transmit Ground line sources approximately 5 volts open circuit. It sources approximately 50 microamperes, which is unlikely to affect or damage other external devices. A low voltage (standard pull-to-ground) is considered "transmit" mode, which disconnects the receive antenna and restores a transceiver (transmitter) to MAIN ANT connection. A valid Transmit Ground occurs when the line is pulled below 1.5 volts. The unit will return to receive mode when the line voltage goes above 3.5 volts. The nominal trigger voltage is TTL logic level, at approximately 2.5 volts. The Transmit Ground line is protected for reverse positive voltages up to 50 volts.

The Transmit Ground line can often, but not always, be "T" or "Y" connected to other external devices. Any incompatibility is unavoidable, because any parallel incompatibility is rooted in the behavior of non-standardized external systems, which are beyond our control.

As shown in RTR-1A Connection Diagrams in this manual, the Ameritron ARB-704 Amplifier Interface may be connected with a Y-adapter, i.e. paralleled, for connection to the Transmit Ground. If that unit is connected with a Multi-Port Din cable from the transceiver, the “Radio” connector on the ARB-704 may be able to be used as the parallel keying connection to Transmit Ground on the RTR-1A. However, internal jumpers in the ARB-704 may be set in such a way as to prevent proper operation of the RTR-1A or the ARB-704 when connected in this manner or with a Y-adapter. Resetting the ARB-704 internal jumpers from 2.5 volts to 5 volts can restore normal operation in some cases.

If any external device prevents the Transmit Ground line voltage from going over 3 volts positive on receive, or prevents a low line (transmit state) from going solidly below 1.5 volts, send-receive switching may become unreliable or unpredictable. The proper test for this is to measure the send and receive mode voltages at the Transmit Ground jack. External devices can be unplugged in order to locate which any external device is preventing normal operation of the Transmit Ground line.

If a troublesome external device is in use, operation is generally correctable with the addition of an external isolation diode, anode to the incompatible external device with cathode towards the Transmit Ground line. A small rectifier diode, such as a 1N4001-1N4007 rectifier, will work with most devices. The RTR-1A already contains an internal isolation diode, so there is no reason to use a diode on the Transmit Ground line.

Some very old equipment supplies 120Vac for external control. In very rare cases, some systems supply a positive-going send voltage, with zero voltage indicating receive. Such systems are not compatible with direct connections to the RTR-1A although they can almost always be interfaced with a few simple external components.
Receive Antenna Input Limiter

The Receive Antenna Input port connects directly to an RF voltage limiter. Regardless of any front panel switch setting and regardless of any power supply system disconnect or failure, this port is clamped at approximately 2 volts peak RF voltage. When power is on, a unique patented clamping system provides a hard limiter at 2 volts. Unlike most other systems, this clamp does not affect signals below 2 volts. Unlike most cheap back-to-back diode limiters, this patented clamp does not compromise or reduce receiver system IMD performance.

This clamping circuit, unless internal shunts on HD1 and HD2 are located rearward to defeat clamping, is always operational. Regardless of power switch setting or state of external power supply lines, any illumination of the Green LED indicates the system is clamping or ready to provide clamping. When fully illuminated, clamping is hard at approximately 2 volts peak.

The clamping circuit can be damaged with application of sustained average RF currents over 100 mA. The normal failure mode is to short the receive port to ground although that is not absolutely guaranteed.

Internal Jumpers

There are two internal jumpers set to factory default positions. HD1 and HD2 are jumpered by default to the top two pins towards the HD1 and HD2 lettering on the printed circuit board for proper operation as shown in Figure 3. This jumper configuration is used to take advantage of the Level Limiter circuitry to help prevent receiver overload damage.

Figure 3 - Internal Jumpers
HD1 and HD2

Connection Descriptions

The diagrams included in this manual demonstrate the wide variety of specific connections that are possible with the DXE-RTR-1A, truly a multi-purpose device. These connections are simple and straightforward and do not require advanced electronics skill.

Connect a regulated station power supply which provides a 1 A fused 12 Vdc to the DXE-RTR-1A power connector on the back panel. With the included 2.1 mm power cord, the power connector must be wired center positive. If a station power supply is not available, connect the optional DXE-PSW-12D1A Wall Transformer.

Typical interconnections between the DXE-RTR-1A, the transceiver, antennas and accessory equipment are made with commonly available or easily made patch cords. Plans should be made to
locate the **DXE-RTR-1A** close to the transceiver, so instant reception antenna changes may be made with the front panel switch.

Receive only connections must be made with either male RCA phono style patch cords or with male F connector cables. Custom length cables with F-Connectors installed can be supplied by DX Engineering. If RCA phono style patch cords are used, high quality connectors should be selected for this low-noise RF application. Inexpensive audio cables may not be suitable. RCA Phono and F-Connectors are used on DX Engineering receive devices to help prevent accidental connection to transmitting connectors.

Transmitting RF connections on the **DXE-RTR-1A**, from RADIO to the transceiver and from MAIN ANTENNA to the transmitting antenna system, tuner or amplifier are made with standard PL-259 patch cables in lengths that permit locating the equipment in their proper operating positions. Custom length cables with PL-259 connectors installed can be supplied by DX Engineering.

The TRANSMIT GROUND keying line connection to the **DXE-RTR-1A** must be made to enable reception with a connected receive antenna or accessory. Keying line connection from transceiver or sequencer (grounding keying line only) for automatic relay switching of RADIO from the RX ANT IN to the to MAIN ANT.

This connection may be shared with an amplifier-transceiver interface buffer keying input. The diagrams in this manual show connections to transceivers with grounded-on-transmit keying line only.

**Note:** If the keying line is shared (using a "Y" adapter) with an amplifier or amplifier interface buffer, then precautions should be taken to be certain that the transceiver to **DXE-RTR-1A** connection is not interrupted.

If the keying line connection from the transceiver to the TRANSMIT GROUND connector on the **DXE-RTR-1A** is lost, transmitted RF may cause damage to the **DXE-RTR-1A** or receiving equipment.

The TRANSMIT GROUND keying line connector **MUST** be connected to a grounded-on-transmit transceiver keying line, cable shield to radio chassis ground, and the RADIO connector must be connected to the transceiver RF connector, cable shield to radio chassis ground, to enable receive mode.

Positive voltage keying will not key the **DXE-RTR-1A** properly.

Damage to the **DXE-RTR-1A** could occur by attempting to use positive voltage keying. Review your transceiver operation manual carefully. Transceivers with positive keying only, must be connected to an interface buffer to provide grounding-on-transmit keying.
Receiving Antenna Spacing Guidelines

The overall benefits that receiving antenna offer is less noise. Weak signals can be heard on a dedicated receive antenna because it rejects noise and strong stations by virtue of its design, size, directivity and lower sensitivity.

Therefore, placement of a receiving antenna is very important. Normally, excellent results are achieved by placing a receive antenna in a low noise environment. If possible, receive antennas should be located at least 1/2-wavelength away from noise sources and noise re-radiating antennas. Houses, other metal or structures containing metal, metal fencing, towers and transmitting antennas can introduce noise into a receive antenna by proximity which may reduce the effectiveness of a receive antenna.

However, in many cases, the physical space required for the ideal receive antenna installation is not available to the average back yard. The following diagrams (1-7) of typical and special system configurations show absolute minimum spacing between transmitting and DX Engineering Active Receive Antennas. For optimal performance, greater spacing is recommended for better reception results.

Diagram 8 shows phasing of a mono-band or multi-band vertical antenna using a DXE-ARAV3-1P Active Receive Vertical Antenna with the DXE-NCC-1 Receive Antenna Phasing Controller. The spacing described is 1/4 to 1/2-wavelength between the transmit antenna and the Active Receive Antenna. This distance is based on optimal performance of the equipment described.

For in-depth receiving antenna system information, please consult the ARRL Antenna Book or ON4UN's Low Band DXing book.

Typical System Configurations

In most cases, the operator will purchase the DXE-RTR-1A because they want to use a receive antenna on a transceiver which lacks a receive antenna input. See the text below and use Diagram 1B for an example using the DXE-RTR-1A with a transceiver having a Receive Input and Output.

All transceivers under 200 watts output may be connected to the DXE-RTR-1A as is shown in Diagram 1A, and all other Diagrams 2 through 9, even if it has a receive antenna input.

Diagram 1A illustrates the positions and connections to a standard transceiver for optional receive enhancement products from DX Engineering. A simple Beverage antenna or receiving loop antenna may be connected directly to the RX ANT connector on the DXE-RTR-1A. If a single DXE-ARAV3-1P Active Receive Vertical is purchased, then the included powering device, model DXE-FVI-1, is placed in-line in the shack between the Active Receive Vertical and the RX ANT input, or between the optional DXE-RPA-1 Receive Preampifier and the DXE-RFCC-1 Receive Feedline Current Choke.

Diagram 1B illustrates how to connect the DXE-RTR-1A to a transceiver using available receive input and output connectors. For informational example purposes, here is a partial listing of the transceivers that can benefit from connections with the DXE-RTR-1A: Yaesu FT-1000 series, FT-1000MP/ MKV series, FT-2000 series and FT-9000 series; Icom IC-7800, IC-7700, IC-7600, IC-765, IC-761 and IC-781.
Most high-end transceivers, old and new, offer a receive antenna input that DOES NOT interrupt or switch off during transmit even though the receiver is muted. Also, on many transceivers, connection of a receive antenna to the RX IN port means that the RX OUT to RX IN jumper patch cord must be removed. Then the transmit antenna cannot be heard. For operators of these high-end transceivers, the **DXE-RTR-1A** offers two benefits. First and foremost, it can protect the front end with automatic disconnection of the receive input, preserving very fast break-in operation (full QSK) with 4 ms response. Second, the **DXE-RTR-1A** offers a simple and handy way to toggle between listening to the receive and transmit antennas with a front panel switch. Third, the **DXE-RTR-1A** has a built-in Level Limiter circuit to help protect your receiver from damage due to strong received signals.

The **DXE-RTR-1A** RX ANT connector is used for the receive antenna system signals. The transceiver RF output is connected to the transmit antenna or amplifier. The transceiver amplifier keying line must be connected to the **DXE-RTR-1A** TRANSMIT GROUND connector to enable reception of the receive antenna signal. Customer supplied RF patch cords must be used to connect to the SO-239 RADIO and MAIN ANT IN ports on the **DXE-RTR-1A** to the RX IN and OUT ports on a transceiver, respectively, replacing the existing jumper patch cable. In most cases these are simply two patch cords with PL-259s on one end and male RCA phono plugs on the other end. This connection will never allow transmitted RF into the front end of the transceiver. Since the RX OUT carries only the received transmit antenna signals, the **DXE-RTR-1A** will allow monitoring of either the receive or transmit antenna as described in this manual. This connection scheme is applicable for the radios listed above, as well as others not listed, which offer RX IN and OUT. This transceiver connection scheme may also be adapted for use with any of the diagramed system configurations. If your transceiver has only a receive antenna input but no RX OUT, use the standard connection methods depicted in Diagrams 1a and 2 through 9.

**Diagram 2** shows a standard transceiver connection arrangement, with the addition of a typical RF amplifier used on the transceiver output for high power operations. The **DXE-RTR-1A** and a keyed-on-ground amplifier may be able to share the same grounding keying line from the transceiver, but the use of an optional amplifier keying interface buffer is recommended. Do not share the keying line of the **DXE-RTR-1A** with an older amplifier that uses high voltage relays.
NOTE: The DXE-RTR-1A may never be used on the output of an RF amplifier. MAXIMUM RF power allowed through the unit is 200 watts.

Note: If the keying line is shared (using a "Y" adapter) with an amplifier or amplifier interface buffer, then precautions should be taken to be certain that the transceiver to DXE-RTR-1A connection is not interrupted.

If the keying line connection from the transceiver to the TRANSMIT GROUND connector on the DXE-RTR-1A is lost, transmitted RF may cause damage to the DXE-RTR-1A or receiving equipment.

The TRANSMIT GROUND keying line connector **MUST** be connected to a grounded-on-transmit transceiver keying line, cable shield to radio chassis ground, and the RADIO connector must be connected to the transceiver RF connector, cable shield to radio chassis ground, to enable receive mode.

Positive voltage keying will not key the DXE-RTR-1A properly. Damage to the DXE-RTR-1A could occur by attempting to use positive voltage keying. Review your transceiver operation manual carefully. Transceivers with only positive keying, must be connected to an interface buffer to provide grounding-on-transmit keying.
Diagram 1A - Active Receive Antenna and Transmit Antenna
Allows use of an active receive antenna with the added receive signal strength using a pre-amplifier.

Optional items shown include: DXE-ARAV2-1P Active Vertical Receive Antenna w/ Internal Antenna Disconnect Relay, DXE-RFCC Receive Feedline Current Choke, DXE-FVI-1 Voltage Injector, DXE-RPA-1 Receiver Preamplifier and DXE-PSW-12D1A +12 Vdc fused 1 amp wall transformer.
Diagram 1B - Active Receive Antenna and Transmit Antenna

Allows use of an active receive antenna with the added receive signal strength using a pre-amplifier connected to a transceiver equipped with RX INPUT and OUTPUT ports.

Minimum 1/10 Wavelength Apart (see text on Receive Antenna Spacing Guidelines)

DXE-ARAV3-1P
Receive Antenna

Receive Feedline Current Choke
DXE-RFCC

Voltage Injector
DXE-FVI-1

Receiver Preamplifier
DXE-RPA-1

+12 Vdc @ 1A Fused
Well Filtered

DXE-RTR-1A

TRANSMIT GROUND

RADIO
MAIN ANT IN

These adapter patch cables are customer supplied with PL-259s and connectors that match the RX IN/RXOUT of the transceiver in place of the existing jumper

Optional items shown include: DXE-ARAV3-1P Active Vertical Receive Antenna w/ Internal Antenna Disconnect Relay, DXE-RFCC Receive Feedline Current Choke, DXE-FVI-1 Voltage Injector, DXE-RPA-1 Receiver Preamplifier and DXE-PSW-12D1A +12 Vdc fused 1 amp wall transformer.
Diagram 2 - Active Receive Antenna and Transmit Antenna using High Power, allows use of an active receive antenna with the added receive signal strength using a pre-amplifier.

Optional items shown include: DXE-ARAV3-1P Active Vertical Receive Antenna w/ Internal Antenna Disconnect Relay, DXE-RFCC Receive Feedline Current Choke, DXE-FVI-1 Voltage Injector, DXE-RPA-1 Receiver Preamplifier, DXE-PSW-12D1A +12 Vdc fused 1 amp wall transformer, Ameritron AL-811 RF Amplifier and Ameritron ARB-704 Amplifier Buffer.
Additional System Configurations

Diagram 3 shows a new receiving application. The DXE-RTR-1A Receive Antenna Interface for Transceivers now allows owners of transceivers which lack a receive antenna input to use a phased receive antenna array. This diagram shows the connections for use of the DXE-AAPS3-1P Electronically Rotatable Receive Antenna System, which consists of two DXE-ARAV3-1P Active Vertical Receive Antennas with Internal Antenna Disconnect Relays and the DXE-NCC-1 Receive Antenna Variable Phasing Controller using the DXE-RTR-1A Receive Transmit Relay.

Diagram 4 details the connections to optional equipment required when operating high power and using the DXE-AAPS3-1P Electronically Rotatable Receive Antenna System. The addition of the DXE-TVSU-1A Time Variable Sequencer Unit will produce the correct keying of all devices, to protect the Active Receive Antennas from high power RF damage. The DXE-RTR-1A provides connection to the transceiver which does not offer a receive antenna input.

Diagram 5 includes the exceptional DXE-RPA-1 Receive Preamplifier in-line with the main (transmit) antenna. For many years Amateurs have been requesting a method to employ a receiving device on their transceivers which lack a built-in preamplifier. The DXE-RTR-1A provides this connection option. Instantaneous receive comparisons between 'preamplifier in' and 'preamplifier out' are easily accomplished using the DXE-RTR-1A MAIN ON - RX ANT - MAIN ON toggle switch.

Receiving with the transmitting antenna on a second transceiver or receiver while operating with the main transceiver connected to a receive antenna is a common contesting application known as Single Operator – Two Radios (SO2R). This is now easily accomplished by connecting the MAIN ANT OUT line to the input of the second radio. Reception with the transmitting antenna is safely interrupted during main transceiver transmissions.

Diagram 6 demonstrates another common use for the DXE-RTR-1A and the connections required for use of a two direction DXE-RBS-1P Reversible Beverage Antenna System.

Diagram 7 shows how a DXE-RFS-TS2P Complete Receive Four Square Array Package for Close Spacing to Transmit Antennas is connected to a transceiver that does not offer a receive antenna input.

Diagram 8 illustrates the use of the DXE-RTR-1A with a DXE-MBVA-1UP Multi-band Vertical Transmit Antenna (a monoband vertical antenna may also be used) one DXE-ARAV3-1P Active Vertical Receive Antenna with Internal Antenna Disconnect Relay, and the DXE-NCC-1 Receive Antenna Variable Phasing Controller. This combination allows the user to null strong receive signals and noise in certain directions, opening up new reception possibilities. When using the DXE-RTR-1A, the Multi-band Vertical transmit antenna can be phased with the Active Receive Antenna using the DXE-NCC-1 Receive Antenna Variable Phasing Controller. The antennas being phased should be the same polarization for optimal results.

Refer to the manual for the DXE-NCC-1 Receive Antenna Variable Phasing Controller (available for viewing or downloading on the DX Engineering website) for more details on directional signal and noise nulling.
Diagram 9 demonstrates how the DXE-RTR-1A may be used in a classic T/R relay application with an added bonus! The popular optional accessory for older receivers, the DX Engineering Receive Preamplifier model DXE-RPA-1, may be used safely, for improving reception on the transmit antenna, especially on higher frequencies. When the pre-amp is not required, it may be internally bypassed by removing the DC power to it.

Set the MAIN ON - RX ANT - MAIN ON toggle switch to the RX ANT (center) position to connect the MAIN ANT to your receiver. When you key the transmitter, the DXE-RTR-1A's automatic 4 ms changeover from receive to transmit switches the MAIN ANT to the transmitter. Manually switching the toggle switch to the MAIN ON (up) position connects the MAIN ANT to the transmitter, if desired for tune up operations. The power limit for the transmitter is 200 watts.

The keying line from the transmitter* must be a Ground-On-Transmit type, as the DXE-RTR-1A cannot accept any keying voltage. If the only keying line from the transmitter is a positive or negative voltage type, then an Ameritron AMR-ARB-704 must be used in the transmitter keying line, as shown in Diagram 9. The ARB-704 will accept any keying voltage, 12 volts positive or negative and provides the Ground-On-Transmit keying for the DXE-RTR-1A.

A muting line from the transmitter which may provide a ground for an older receiver, cannot be shared with the DXE-RTR-1A, as many old receivers* require the grounding of a high voltage for muting.

* Refer to your transmitter and receiver instruction manuals for keying line and muting line information and requirements.

In a special application with no receive antenna connections, Diagram 10 illustrates using the DXE-RTR-1A with an optional DXE-RSC-2 Two-Port Splitter/Combiner to allow one transmitting antenna to be shared for simultaneous receive on two transceivers or with one transceiver and one receiver. The second radio is isolated from transmit energy by the DXE-RTR-1A. Only the main transceiver may be used to transmit. The second transceiver that is connected to one of the DXE-RSC-2 outputs must be transmit inhibited using either the radio's menu settings or power output controls set to zero to prevent system damage.

Set the MAIN ON - RX ANT - MAIN ON toggle switch to the RX ANT (center) position to connect the MAIN ANT to both radios for simultaneous reception. When you key the main transmitter, the DXE-RTR-1A automatically changes from receive on both radios to transmit on the MAIN ANT in only 4 ms. The strong signal heard by the second radio is at a level that cannot damage its front end. Manually switching the toggle switch to the MAIN ON (up) position connects the MAIN ANT to the main transceiver, if desired for tune up operations, or for normal operations without the second radio. The power limit for the transmitter is 200 watts.

Diagram 11 demonstrates how the DXE-RSC-2 Two-Port Splitter/Combiners can be used to split the active receive signal to the DXE-RTR-1A and a second radio. In most low band operations, the receive antenna system will provide superior reception compared to the transmit antenna. An active receive antenna offers the signal-to-noise advantage that allows weak DX signals to be heard which would otherwise be covered by noise when listening with the transmit antenna. The second transceiver that is connected to one of the DXE-RSC-2 outputs must be transmit inhibited using either the radio's menu settings or power output controls set to zero to prevent system damage.
Optional items shown include: **DXE-AARV3-1P** Active Vertical Receive Antennas with Internal Antenna Disconnect Relays. **DXE-NCC-1** Receive Antenna Variable Phasing Controller and **DXE-PSW-12D1A** +12 Vdc fused 1 amp wall transformer.
Diagram 4 - DXE-NCC-1 Receive Antenna Variable Phasing Controller with two Active Receive Antennas using high power to the transmit antenna.

Optional items shown include: DXE-AAPS3-1P Electronically Rotatable Receive Antenna System (which includes two DXE-ARAV3-1P Active Receive Antennas and one DXE-NCC-1 Receive Antenna Variable Phasing Controller), DXE-TVSU-1A Time Variable Sequencer Unit, Ameritron AL-811 Amplifier, Ameriton ARB-704 Buffer, MFJ-998 Antenna Intellituner, CW Key, Foot Switch, DXE-PSW-12D1A +12 Vdc fused 1 amp wall transformer and the DXE-MBVA-1UP Multi-band Vertical Antenna.
Diagram 5 - Single Transmit Antenna System using a DXE-RPA-1 Preamplifier

Optional items shown include: DXE-RPA-1 Receiver Preamplifier and DXE-PSW-12D1A +12 Vdc fused 1 amp wall transformer.

Notes:
For clarity - not all connections are shown
Optional Items: Refer to product manuals for detailed connections
Diagram 6 - Single Transmit Antenna System using a DXE-RBS-1 Reversible Beverage Antenna System

Optional items shown include: DXE-RBS-1P Reversible Beverage Antenna System - Two Direction, DXE-CC-8A Control Console, DXE-FVC-1 Feedpoint Voltage Coupler, DXE-RPA-1 Receiver Preamplifier and DXE-PSW-12D1A +12 Vdc fused 1 amp wall transformer.
Diagram 7 - Single Transmit Antenna with the DXE-RFS-TS2P Receive Four Square Array Package for Close Spacing to Transmit Antennas

Optional items shown include: DXE-RFS-TS3P Receive Four Square Array Package for Close Spacing to Transmit Antennas, (which includes: (1) DXE-ARAV3-4P Package of 4 Active Receive Vertical Antennas w/ Internal Antenna Disconnect Relays, (1) DXE-RFS-2 Receiving Four Square Antenna Switch, (1) DXE-CC-8A 8 Position Control Console, (1) DXE-TVSU-1A Time Variable Sequence Unit, (1) DXE-F6-1000 CATV F-6 Style Coax, 75 ohm, F6 Flooded for Direct Burial, 1000' Spool, (25) DXE-SNS6-25 Snap-N-Seal 75 Ohm Coax Connectors for CATV F-6 Cable, (1) DXE-SNS-CT1 Crimp Tool for Snap-N-Seal 75 Ohm Coax Connectors, (1) DXE-CPT-659 CATV F-6, RG-6 and RG-59 Coax Cable Stripper, Includes 1 Replacement Blade). Optional Items: PolyPhaser Lightning Protector, 75 ohm, DC Pass, Type F Connectors, DXE-RPA-1 Receiver Preamplifier and a DXE-PSW-12D1A +12 Vdc fused 1 amp wall transformer.
Diagram 8 - One Monoband or Multi-band Vertical Antenna phased with a DXE-ARAV2-1P Active Receive Antenna using the DXE-NCC-1 Receive Antenna Variable Phasing Controller

Optional items shown include: DXE-ARAV3-1P Active Receive Antenna, DXE-NCC-1 Receive Antenna Variable Phasing Controller, DXE-PSW-12D1A +12 Vdc fused 1 amp wall transformer, DXE-MBVA-1UP Multi-band Vertical Antenna and a wideband MFJ-993B automatic tuner.
Diagram 9 - Classic T/R relay connections for separate Transmitter and Receiver with a Single Transmit Antenna System using a DXE-RPA-1 Preamplifier

Notes:
For clarity - not all connections are shown
Optional Items: Refer to product manuals for detailed connections

Optional items shown include: DXE-RPA-1 Receiver Preamplifier an the Ameriton ARB-704 Buffer.
Diagram 10 - Relay connections for separate Transceiver and Receiver with a Single Transmit Antenna System using a DXE-RSC-2 Two-Port Splitter/Combiner

Optional items shown include: DXE-RSC-2 Two-Port Splitter/Combiner, Ameriton ARB-704 Buffer and DXE-RG-5000 Receiver Guard 5000 Electronic RF Limiter. Note: the RG-5000 can be incorporated in other diagrams (connection schemes) where needed.
Diagram 11 - Relay connections for separate Transceiver and Receiver with an Active Receive and Single Transmit Antenna System using a DXE-RSC-2 Two-Port Splitter/Combiner

Optional items shown include: DXE-RSC-2 Two-Port Splitter/Combiner, DXE-ARAV3-1P Active Receive Antenna, DXE-RFCC Receive Feedline Current Choke, DXE-FVI-1 Voltage Injector, DXE-RPA-1 Receive Preamplifier, DXE-RSC-2 Two-Port Splitter/Combiner and DXE-PSW-12D1A +12 Vdc fused 1 amp wall transformer.
**Operation**

Once all connections have been made and double checked, turning PWR on the **DXE-RTR-1A** will illuminate the green LED.

The three position MAIN ON - RX ANT - MAIN ON toggle switch for manual control of the **DXE-RTR-1A** antenna selections.

- **MAIN ON** (toggle switch up)
  Manually switches the transceiver (RADIO) to the MAIN ANT for receiving with the transmitting antenna. The transceiver will remain connected to MAIN ANT during transmit. The red LED will not illuminate.

- **RX ANT** (toggle switch center)
  Place the switch in this position for reception with a receive antenna. This position connects the RADIO to the RX ANT for receive mode on a receive antenna and allows automatic switching of the RADIO to the MAIN ANT during transmit. The red LED will illuminate only during receive with the receive antenna and will extinguish when the transceiver switches to transmitting.

- **MAIN ON** (toggle switch momentary down)
  Manually switches RADIO to MAIN ANT momentarily for a fast check of reception on the transmitting MAIN ANT.

**Manual Updates**

Every effort is made to supply the latest manual revision with each product. Occasionally a manual will be updated between the time your DX Engineering product is shipped and when you receive it. Please check the DX Engineering web site ([www.dxengineering.com](http://www.dxengineering.com)) for the latest revision manual.

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**Note:** If the keying line is shared (using a "Y" adapter) with an amplifier or amplifier interface buffer, then precautions should be taken to be certain that the transceiver to **DXE-RTR-1A** connection is not interrupted.

If the keying line connection from the transceiver to the TRANSMIT GROUND connector on the **DXE-RTR-1A** is lost, transmitted RF may cause damage to the **DXE-RTR-1A** or receiving equipment.

The TRANSMIT GROUND keying line connector **MUST** be connected to a grounded-on-transmit transceiver keying line, cable shield to radio chassis ground, and the RADIO connector must be connected to the transceiver RF connector, cable shield to radio chassis ground, to enable receive mode.

Positive voltage keying will not key the **DXE-RTR-1A** properly.

Damage to the **DXE-RTR-1A** could occur by attempting to use positive voltage keying. Review your transceiver operation manual carefully. Transceivers with positive keying only must be connected to an interface buffer to provide grounding-on-transmit keying.
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.

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.

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.

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