

# Beverage Feedpoint Matching System

**DXE-BFS-1**

*Patent Pending*

DXE-BFS-1-INS Revision 3a



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## Introduction

The **DXE-BFS-1** is a single-wire, single direction Beverage Feed System. This W8JI design is immune to strong signal overload and core saturation common in multi-transmitter contesting environments, and is used by winning contest stations and low-band DXers. The unit uses an isolated-winding, matching transformer system to significantly increase the signal-to-noise ratio in Beverage and other high impedance antennas.

The **DXE-BFS-1** works with antenna impedances from 400 to 500  $\Omega$ . Included with the **DXE-BFS-1** is a 470  $\Omega$ , 2-Watt non-inductive termination resistor that withstands nearby lightning strikes significantly better than hard to find carbon composition resistors. DX Engineering has replacement resistors available, part number **DXE-ECM-R470-2**.



The feedline impedance of the **DXE-BFS-1** is optimized for 75  $\Omega$ , however, any feedline between 30  $\Omega$  and 100  $\Omega$  can be used. While not intended for transmitting, the **DXE-BFS-1** can withstand power levels of 20 watts continuously, 200 watts for 5 seconds or the power rating of the termination resistor, whichever is less. The **DXE-BFS-1** coaxial cable connection uses an industry standard CATV F type connector.

The **DXE-BFS-1** sets itself apart from competitive products by combining quality components and superior technology inside a compact metal housing.

## Features

- 100 kHz to 30 MHz operating range
- Integral spark gaps built into the internal printed circuit board minimize damage from lightning
- Wing nut terminals eliminate soldering
- Metal housings used for superior shielding and improved life
- Flange-mount holes for easy mounting
- Ground isolated secondary essential for building beverage arrays and can be connected with normal or reverse phase
- RoHS compliant assembly

The **DXE-BFS-1** uses an isolated-winding, matching transformer system that significantly increases the signal to noise ratio in Beverage and other high impedance antennas. This unit is immune to strong signal overload and core saturation common in multi-transmitter contesting environments, and is used by winning contest stations and low-band DXers.

## Coaxial Cable and Connectors

The feedpoint matching system is optimized for 75  $\Omega$  feedline. This allows the use of 75  $\Omega$  CATV type coaxial cable and F style connectors. We recommend using high quality “flooded” 75  $\Omega$  RG-6 type coaxial cable, DX Engineering part number **DXE-F6-CTL** or **DXE-F6-1000**. Flooded coaxial

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. To ensure weatherproof connections, use Snap-N-Seal connectors. DX Engineering part number **DXE-SNS6-25** contains 25 Snap-N-Seal connectors. The Snap-N-Seal connectors cannot be installed with normal crimping tools or pliers, so an installation tool like the **DXE-SNS-CT1** is essential for proper connector installation.

## Additional Requirements

Please note you will need the following items (not included in this package) to install and operate the **DXE-BFS-1** antenna:

- **Antenna wire:** You will need a minimum of  $3/8$  wavelength of wire of any gauge between #8 and #20.
- **Ground rods:** Use at least one 5-ft copper rod.
- **Insulators and supports:** Insulators and supports are required to support the antenna wire 5 to 10 feet above ground. Supports can be metallic but the antenna wire must be insulated from them.

## Specifications

<b>Operating Frequency:</b>	100 KHz to 30 MHz
<b>Input Impedance:</b>	400-500 $\Omega$
<b>Output Impedance:</b>	30-100 $\Omega$ (75 $\Omega$ recommended)
<b>Common Mode Isolation:</b>	20-30 dB (feedline and antenna)
<b>Power Handling:</b>	20 watts continuously or 200 watts for 5 seconds
<b>Termination Resistance:</b>	400-500 $\Omega$

## Installation

We strongly suggest that you read the entire **DXE-BFS-1** manual before installing the antenna, and make sure you understand the concepts outlined in the sidebar (below) that are critical to proper operation.

## Isolation

The **DXE-BFS-1** operates on the principle of a transformer with isolated antenna and feedline connections. This prevents the feedline from contributing unwanted electrical noise or signals to the receiver. Many antenna enthusiasts unwittingly connect their feedline to their matching system housing, not realizing that the practice simply makes the antenna longer and increases unwanted signals. The **DXE-BFS-1** solves this problem by insulating the connection lugs from the housing, which also isolates the antenna from the feedline.

## Performance Factors

For an effective Beverage antenna, you will need at least 3/8 wavelength of wire. Acceptable wire types include galvanized or cadmium-plated steel electric fence wiring, stranded or solid copper wire, and steel-core wires like copperweld. Avoid wire designed for welding applications. The line with the best mechanical and electrical characteristics is generally #16 gauge copper clad steel (copperweld) wire. Aluminum wires will work, but connections and splices are problematic due to the formation of aluminum oxide.

### Critical Installation Information

**Transmitting** The **DXE-BFS-1** is designed for use in receiving antennas: do not transmit through the **DXE-BFS-1** with more power than the rating of the termination resistor (a 2-watt resistor is included with the unit). This system will not be damaged by transmissions from other antennas as long as the **DXE-BFS-1** is more than one half wavelength from the transmitting antenna and the power is less than 1500 watts.

**Grounding** To ground the antenna, run a wire from the – terminal of the **DXE-BFS-1** to the ground rod or rods. The antenna system is **NOT** grounded through the metal case. Feedline terminals are engineered to be ground independent of the metal housing and whatever that housing is mounted on. **DO NOT** ground the case to the antenna ground, since that will connect the feedline shield to the antenna system and possibly increase noise or reduce directivity of the antenna.

**Termination** The far end of the antenna must be properly terminated, or the antenna will not have the best F/B ratio. Failure to terminate the antenna will generally result in a reduction of S/N ratio as high as 20 dB, depending on noise arrival direction. For best results, use the termination resistor included in this package.

## Antenna Length

The chart below shows relative performance of Beverage antennas based on wire length:

Antenna Performance Based on Length				
Antenna Length	160 Meter Band	80 Meter Band	40 Meter Band	20 Meter Band
120 Feet	Too Short	Marginal	Good	Good
240 Feet	Marginal	Good	Best	Good
360 Feet	Fair	Best	Best	Good
480 Feet	Good	Best	Good	Good
600 Feet	Better	Good	Good	Good - Marginal
720 Feet	Best	Good	Good	Marginal

The antenna can be any length between 3/8-wavelength through multiple wavelengths, although we recommend using lengths similar to those in the table above. In most cases, the **DXE-BFS-1** performance is excellent even when the antenna is not cut to the ideal length.

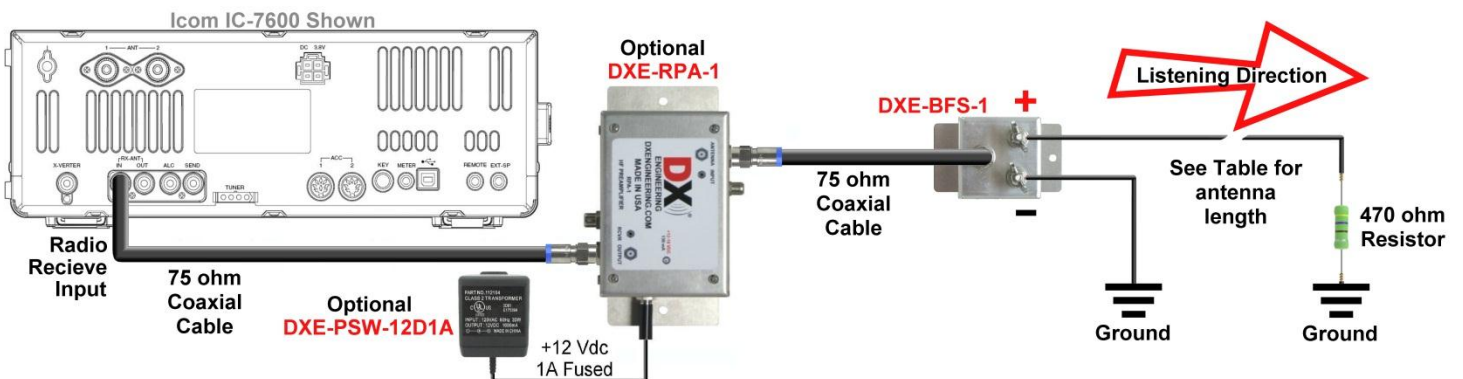
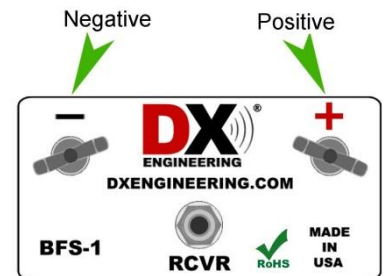
## Location

Beverage antennas work well and are easy to install; you can make reasonable height changes, drape the antenna over tree branches, and deviate orientation by as much as 10 degrees. Metal poles will not affect the antenna's performance as long as the wire is insulated from the pole. Avoid placing the antenna near transmitting antennas, power lines, large metal fences, or over buried cables. Install the antenna wires 5-8 feet above the ground. It is not necessary to follow the contour of the land because small hills, ravines and ditches generally do not affect the antenna. Contrary to popular belief, sloping the antenna wire does not improve performance. The picture shown uses typical electric fence wire holders mounted on top of wooden posts with the beverage antenna wire strung through.



## Connections

The **DXE-BFS-1** Feed Point unit has antenna terminals marked + (positive) and - (negative). Normally, the + side goes to the antenna wire and the - terminal goes to the antenna ground as shown in the drawing below. When building Beverage arrays, phase can be reversed by simply reversing the connections. The **DXE-BFS-1** also has ground-isolated secondaries which are essential for array construction. Do not ground the case of the **DXE-BFS-1** to the antenna ground system.



## Grounding

Ground the ends with at least one five-foot copper rod. 3/4 inch copper water pipe is ideal. A five-foot rod typically has 50-150  $\Omega$  RF resistance on 160 meters. For most soil types, you should use two or more rods spaced at least five feet apart. Longer rods generally do not improve RF grounding because RF skin depth prevents deep ends from having much effect. Do not connect the coax shield to the antenna ground. Isolating the feedline and antenna grounds will prevent the feedline shield from becoming an unintentional antenna ground and introducing unwanted signals and noise.

NOTE: *Be sure to use the wing nut terminal on the case for the antenna ground. The metal case is **NOT** connected to the antenna ground, and should not be connected to the antenna ground.*

## Feedline

The **DXE-BFS-1** uses standard CATV “F” connectors. We recommend using **DXE-SNS6-25** Watertight Snap-N-Seal F connectors and DX Engineering custom made high quality 75  $\Omega$  “flooded” F6 type cables because they are generally high quality and have excellent shielding. Be sure to use a coax sealant or install a rain hood over cable connections, and follow all appropriate wiring codes for grounding where cables enter a building. Bury the feed cable for 10 feet or more when approaching the feedpoint, or ground the feedline shield to a separate ground rod.

## Termination

The far end of the antenna must be terminated, typically at 450 to 500  $\Omega$ , or the antenna will not have the optimum F/B ratio. Failure to terminate the antenna always results in a reduction of S/N ratio. S/N reduction can be as much as twenty dB, depending on the noise arrival direction. A special termination resistor is included in this package. This high-energy, metal composition resistor has stable electrical characteristics, almost no inductance, and withstands severe overloads. DX Engineering has replacement resistors available, part number **DXE-ECM-R470-2**.



## Lightning Protection

This unit features small air gaps and wide foil trace areas, as well as entrance gaps at all feed-through terminals. The gaps act as safe, short paths for lightning discharges. The **DXE-BFS-1** is normally immune to nearby lightning, although a direct strike might cause component failure. For additional lightning protection, consider using a one-foot link of #26 wire between the antenna terminals and the antenna. This wire will act like a fuse link and help protect against severe lightning energy.

## **Simplified Testing**

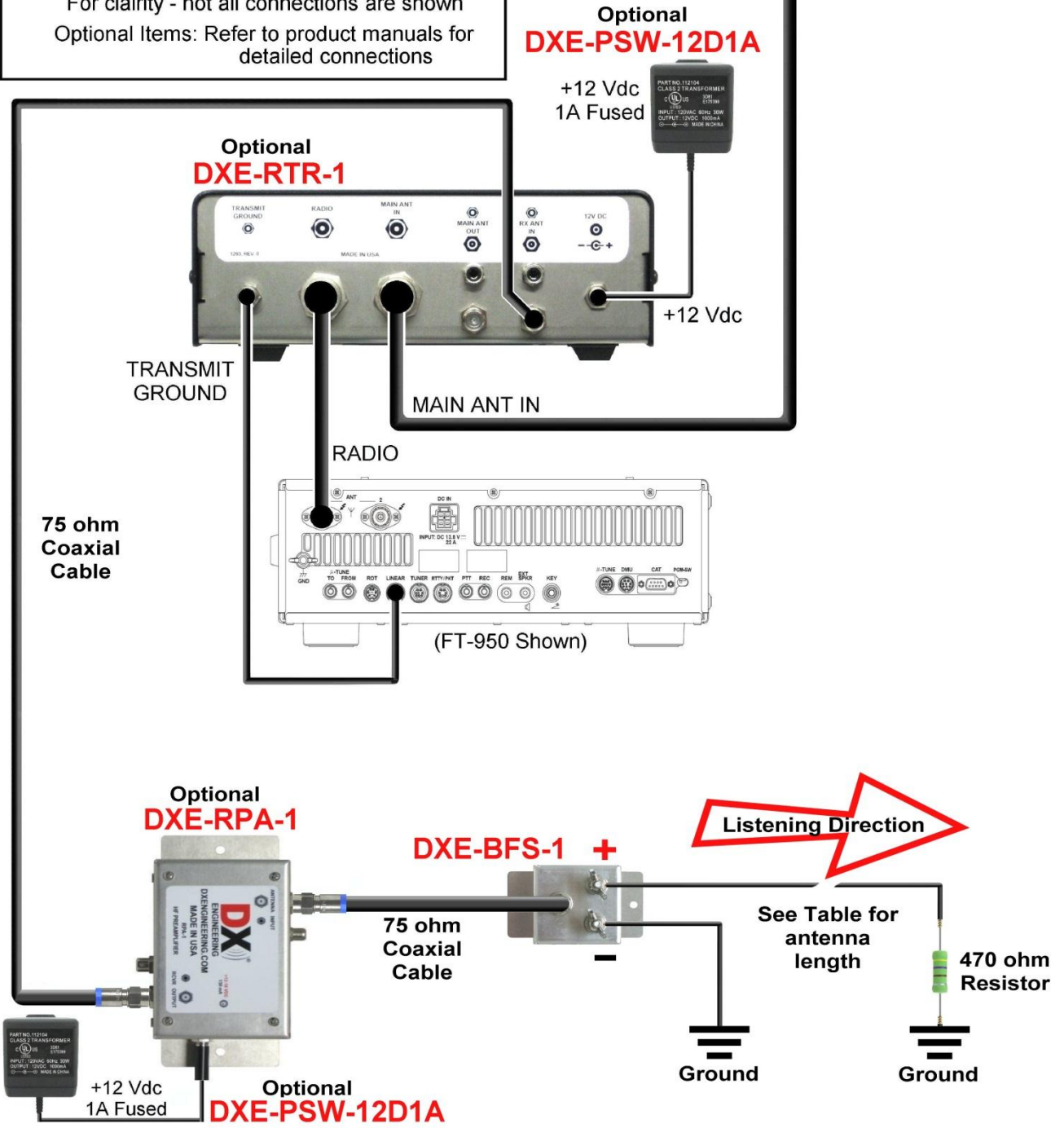
The **DXE-BFS-1** feedpoint matching system is not only easy to use, it can also be tested in its operating configuration. Just attach a standard SWR analyzer to test the antenna, the termination and the **DXE-BFS-1** as a single entity. Properly functioning systems will show a reasonably constant SWR value over several bands. The SWR does not have to be low (it is typically under 1.8:1) but should change gradually over large variations in frequency

For more information about Beverage construction, see *"ON4UN's book on Low Band DX'ing"*.

# Alternate Radio Connection

The following diagram shows the **DXE-BFS-1** connected to a radio that does not have a Receive Antenna Input. This set up allows switching between a transmit antenna and the beverage antenna using the **DXE-RTR-1A** Receive Antenna Interface. Refer to the **DXE-RTR-1A** Receive Antenna Interface manual for more information.

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





## 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.

## Optional Items

### **DXE-ECM-R470-2 470-ohm, 2 W Beverage Termination Resistor Lightning Damage Resistant, Pack of 10**

This special non-inductive resistor can absorb extreme amounts of power for short periods without damage. It has the highest surge immunity of any 2-watt leaded (with leads) carbon or metal resistor. Metal-film and carbon-film resistors easily fail from even minor electrical disturbances. Ideal for use as a Beverage terminator, the DXE resistor withstands nearby lightning strikes significantly better than hard-to-find carbon composition resistors. It is superior to carbon composition resistors in real life, retaining resistance value despite exposure to heat and power surges.



### **DXE-ANTW-1000 #14 Insulated Antenna Wire, Multiple Antennas, 1000 Ft.**

Use this wire to achieve top performance and long, trouble free operation. This antenna wire kit uses insulated wire that is UV resistant and pays out easily, unlike the wire that is commonly available at the big box stores which coils and kinks. It will last much longer in contact with the environment than bare wire.

- Heavy #14 AWG stranded copper antenna wire
- 1000 foot bulk length spool
- UV-resistant relaxed black PVC insulation
- Reduces precipitation static
- Long, reliable life



### **DXE-RPA-1 - Receiver Preamp 0.3-35 MHz**

This is the best HF low noise amplifier available. The 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 RPA-1 is better than most receivers.

**The RPA-1 is actually capable of providing protection against high RF levels and ESD for many transceivers with un-switched, unprotected receive antenna inputs!**

The RPA-1 is suitable for indoor or outdoor installation, with the option of being powered through the coaxial feed. The metal housing provides shielding and improved lifespan. The unit uses RCA type phono jack and CATV F connector for the input and output connections, and has a relay that automatically bypasses the amplifier when dc power is removed.

#### **Benefits:**

- 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 jack and type F connector ease installation
- Simplified switching - automatic bypass eliminates gain when dc power is off
- 10-18 Vdc power using power connector or through the coax
- 10-18 Vdc through coax enables remote operation at antenna



### **DXE-PSW-12D1A - AC Adapter 12 VDC/1000 mA**

The DXE-PSW-12D1A is an AC Wall Transformer Adapter to furnish 12 Volts DC at 1000 mA from 110 Vac 60 Hz input, fused output. It features a standard 2.1 mm plug connection for 12 Vdc. Outer connection is GROUND Center Pin is input for +12 VDC. Ideal separate power source for DX Engineering Transmit Four Square Controllers, NCC-1, TVSU-1 and the Remote Antenna Tuner Kit.



### **DXE-SNS6-25 Watertight Coax Connector, Snap-N-Seal for CATV F-6 Cable, 25 pieces**

Snap-N-Seal is an environmentally sealed CATV F coax 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 (-95dB 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 iridescent clear 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, to install the connectors. Normal crimping tools or pliers will not work.

### **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

The case-only may be ordered as DXE-F6-CASE.



### **75Ω F-6 Style, Direct Bury Coax: Full Spool or Custom Cable Assemblies**

**DXE-F6-CTL 75Ω F-6 Style Direct Bury Coax, Per Foot**

**DXE-F6-1000 75Ω F-6 Style Direct Bury Coax, 1000 ft. Spool**

We recommend using a high quality 75 Ω “flooded” F6 type coax. 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 with connectors available - Call for details.**



### **DXE-RTR-1A Receive Antenna Interface for Transceivers**

Now you can add a dedicated receive antenna to HF transceivers which lack a separate RX antenna input port - or protect an un-switched RX ANT port on your transceiver! The DXE-RTR-1 Receive Antenna Interface (Patent Pending) is a unique multi-purpose switch unit which automatically or manually switches the RF output antenna connector on any HF transceiver between a separate receiving antenna system and a standard transmitting antenna. The switching is fast enough - about 4 ms. - to allow QSK CW operation. In its simplest application, it allows you to add a receiving preamp to improve reception of those really weak ones! The DXE-RTR-1 enables operators to enjoy the improved reception that a low noise receiving antenna system offers. Connection to a Beverage, Receive Four-Square, Active Receive Antenna, and other receiving antennas and accessories is now possible, safely, only with the DXE-RTR-1.



Requires 12 VDC for operation, or order DXE-PSW-12D1A AC adapter.

- Attractive Heavy Stainless Steel Enclosure
- 200 Watt Switching Capability
- Supports CW full break in
- Main Antenna has SO-239 connector
- Receive Outputs use RCA phono and Type F connectors
- Safe switching - transmit antenna is always connected to transceiver on power-off
- Hot switching lockout - disables receive antenna during transmit mode
- Versatile - allows inclusion of RF Preamps and other RX accessories

### **ARR-8560 - ARRL ON4UN's Low Band DXing, 5th Edition**

The fifth edition features new and updated material. **Highlights include...**

...a thoroughly revised discussion of **receiving antennas**. You'll discover how to greatly enhance their operational bandwidth. In addition, low-signal transformers for Beverages and other receive-only antennas are analyzed in great detail, along with effective common-mode filters.

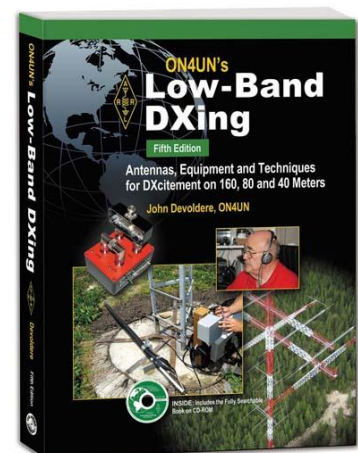
...a new examination of **phased arrays**, with new concepts such as the hybrid-fed 4-square array and opposite-voltage feed system. This is a must-read for every serious antenna builder!

...dozens of new propagation maps based on DX Atlas, as well as an in-depth analysis of the influence of sunspot cycles on 160-meter ducting.

...a new discussion of cutting edge technology including **Software Defined Radio** and the revolutionary **LP-500 Digital Station Monitor**.

#### **Contents:**

- Propagation
- DXing on the Low Bands
- Receiving and Transmitting Equipment
- Antenna Design Software
- Antennas: General, Terms, Definitions
- The Feed Line and the Antenna
- Receiving Antennas
- The Dipole Antenna
- Vertical Antennas
- Large Loop Antennas
- Phased Arrays
- Other Arrays
- Yagis and Quads
- Low Band DXing from a Small Garden
- From Low Band DXing to Contesting
- 



**CD-ROM included!** The CD-ROM includes the entire book in a fully searchable PDF format as well as ON4UN's software (Windows XP only), antenna modeling files, photographs and more.

## 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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