



## Multi-Band Dipoles

**DXE-WA Series**

DXE-WA-INS-Series Rev. 2b



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## Introduction

The DX Engineering Multi-Band Dipoles are designed to be rugged yet lightweight. Using a tuner, they are usable to 30 MHz. They come complete with the appropriate length wire elements, 100 feet of premium 300  $\Omega$  ladder feedline, Center-T support (U.S. Patent No. 7,764,244), and end mounting insulators (U.S. Patent No. D534905). All hardware is stainless steel.

## Dipole Models

There are 3 configurations. Each model resonates at the low end of the respective 160, 80 or 40m band:

Part Number	Length in Feet	Band Coverage
<b>DXE-WA-260</b>	260	160m to 10m
<b>DXE-WA-135</b>	135	80m to 10m
<b>DXE-WA-70</b>	70	40m to 10m

## Specifications

All DX Engineering Multi-Band Dipole Antennas are usable from their lowest resonant frequency to 30MHz. They are built using the highest quality components.

- Elements - 14 AWG stranded copper, PVC jacket for flexibility and strength
- Feedline - 18 AWG stranded, 300  $\Omega$  ladder line, UV-resistant, 0.88 VF
- Hardware - Stainless steel
- Center-T support (U.S. Patent No. 7,764,244) and end-insulators (U.S. Patent No. D534905) - Black, high impact, and UV-resistant
- Power rating - Dependent on the rating of the tuner or balun; built-in or external

When using an external balun, such as the DX Engineering **DXE-BAL050-H05-A** (rated at 2kW continuous) or the **DXE-BAL050-H10-A** (rated at 5kW), the limiting factor may be the tuner.

Note: **UMI-81343** Never-Seez or **DXE-NSBT8** Anti-Seize should be used on all clamps, bolts and stainless steel threaded hardware to prevent galling and to ensure proper tightening.

## Safety Considerations

### WARNING!

INSTALLATION OF ANY ANTENNA NEAR POWER LINES IS DANGEROUS



**Warning:** Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, because they may cause serious injury or death.

#### Overhead Power Line Safety

Before you begin working, check carefully for overhead power lines in the area you will be working. Don't assume that wires are telephone or cable lines: check with your electric utility for advice

Although overhead power lines may appear to be insulated, often these coverings are intended only to protect metal wires from weather conditions and may not protect you from electric shock

Keep your distance! Remember the 10-foot rule: When carrying and using ladders and other long tools, keep them at least 10 feet away from all overhead lines - including any lines from the power pole to your home.

## Mounting Considerations

When planning the location of your antenna, consideration should be given to the height, location of suitable support structures and feedline positioning and length.

Generally speaking, these antennas should be mounted as high as possible for best performance. Antenna height will affect the exact resonance point, radiation pattern, and takeoff angle. The higher the antenna, the lower the takeoff angle to the horizon, which increases the effective range of the antenna.

For DX, the minimum height above ground should be 1/2-to 1-wavelength at the lowest operating frequency. On the low bands, this height becomes impractical for most hams. For example, an 80m dipole at 70 feet is about 1/4-wavelength above the ground. This antenna would be good for local and short distance communications, but not optimal for DX, due to the high takeoff angle and ground absorption. A 40m dipole at 70 feet is approximately 1/2-wavelength high and is likely to be good for DX and less optimal for local or short range communications. For more information on antenna design, feedline and radiation angles, consult a reliable text such as the ARRL Antenna Book.

The antenna, including the 300 Ω feedline, should also be mounted as far from other structures as possible. This includes the ends of the wire elements, which are actually the most sensitive part of the antenna. Any objects, metal in particular, within the near-field radiation pattern can affect the impedance and radiation pattern of the antenna.

The feedline should also come away from the antenna at right angles for at least 1/2-wavelength for best performance.

Most installations involve compromises due to local terrain, available supporting structures, or other restrictions. Do the best you can with what you have.

## Installation

You should have two rolls of element wire, one 100 foot roll of 300 Ω ladder feedline, a hardware packet, and a packet containing four wire lugs. Two of the lugs accommodate 14 gauge wire and are used for the elements. The smaller lugs accommodate 18 gauge wire and are used for the feedline.

## Feedline

Unroll the 2 wire elements and the feedline using a hand-over-hand technique. This will prevent kinks and allow the wire to lay flat for assembly.

The DX Engineering Multi-Band Dipoles include 100 feet of high quality 300 Ω ladder line. Depending on your specific installation, this feedline will need to be shortened or lengthened.

The feedline must be in **odd** multiple lengths of 1/8-wavelength on the lowest operating frequency to optimize the impedance presented to the balun over the frequency range of the antenna. This length can be calculated using the following formula, or use **Table 1**.

The DX Engineering 300 Ω ladder feedline has a VF of 0.88.

### Formula:

**123 / Freq (MHz) x VF: Multiply the result times the ODD multiple (1, 3, 5, 7, etc.) to get the correct length that is closest to your required feedline length.**

### **Where:**

123 = 1/8-Wavelength Factor

Freq = Frequency in MHz

VF = Velocity Factor of Feedline

$$\text{Length} = \frac{123}{\text{Freq (MHz)}} \times 0.88$$

**Table 1: 1/8-Wavelength Feedline Calculator**

Frequency (MHz)	Half-Wave Dipole (ft)	Make feedline an odd Multiple of this length in Feet (x 1, 3, 5, etc.)
1.8	260	60.1
3.5	134	30.9
5.3	88	20.4
7	67	15.4
10.1	46	10.7
14	33	7.7
18	26	6
21	22	5.2
24	20	4.5
28	17	3.9

**Example:** To use an antenna from 80m to 10m, the feedline should be in odd 1/8 wavelength multiples on 80m.

The 80m band starts at 3.5 MHz. Therefore,  $123/3.5=35.1$ . DX Engineering feedline has a VF of 0.88, so  $35.1 \times 0.88=30.9$  ft. per 1/8-wavelength.

If 90 feet is needed to get to our operating position, the nearest odd multiple 1/8 wavelength length is 92.7 feet. ( $30.9 \times 3$ ).

If we needed 110 feet, we would have to add to the feedline to achieve 154.5 feet ( $30.9 \times 5$ ) to maintain the odd 1/8th multiple-rule for length

If you have excess ladder line, it can be zigzagged while suspended in air, but it can't be closer than a few conductor spacings to metallic objects and **should not be coiled**. If it is necessary to pass close to a metallic object, twist the line to partially balance the affect on both sides of the feedline.

If you need additional feedline, 100 ft. rolls (part number **DXE-LL300-1C**) and a convenient line coupler (part number **DXE-LLC-1P**) are available from DX Engineering. The line coupler includes a high impact, insulated splice block, ring terminals and stainless hardware, permitting strong and consistent splices of ladder line. See **Figure 3**.

*Note: If using an external balun, the feedline length should be calculated to the balun.*

Often, a 4:1 balun is suggested for Multi-Band Dipoles; however, the best balun to use for this application is a 1:1 ratio. The impedance at the end of the feedline will vary from very high to very low. Tuners have an easier time with high impedance than a low one. A balun with a ratio of 4:1 or more will transform the already low impedance to an even lower one that will make the antenna hard to tune. The 1:1 ratio balun will just pass the low impedance through.

The correct DX Engineering 1:1 Current Balun is **DXE-BAL050-H10-AT**. This balun provides better balance, has lower loss, and is more tolerant to load impedance and balance variations than other baluns.

Even when properly done, this arrangement will subject the coaxial line between the tuner and balun to very high standing waves and high voltage and/or current. Keep the coaxial line length as short as possible, **but** do not route the parallel line so close to the tuner or the rest of the station equipment that RF feedback occurs. This will manifest itself by making the antenna very difficult to tune and the tuner controls will be very touchy. There may also be RF present on the microphone, key, etc. At a minimum, use good low loss coaxial line like **DXE-213U** an RG-213 or equivalent. RG8X and smaller coax will not do a proper job.

## Assembling the Dipole

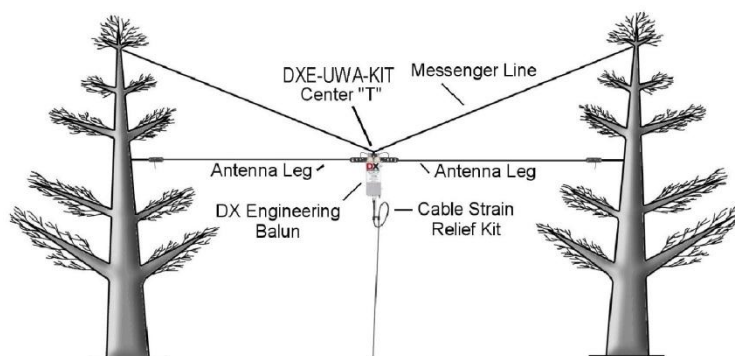
### Center-T Support

The Center-T (U.S. Patent No. 7,764,244) support has pre-drilled holes for attachment of the wire elements, feedline, and a support or messenger line.

### Support Line

The center-T support top hole is used for the attachment of a “messenger line” that can be strung above the antenna wire and is used to provide support for the antenna wire and feedline. The use of the messenger line, which is strongly recommended, will reduce stress on the element wires and keep the antenna from stretching over time, which will change its resonant frequency. This line can be thin Dacron rope, such as the DX Engineering **SYN-DBR-94-100**, which has a breaking strength of 260 pounds.

Determine the required length for the messenger line. Ideally, it should attach to the same structure used for the dipole, only above it, forming at least a 30 degree angle between the dipole and the messenger line. The ends of the rope should be cauterized with a small flame to prevent the rope braid from fraying. See **Figure 1**.

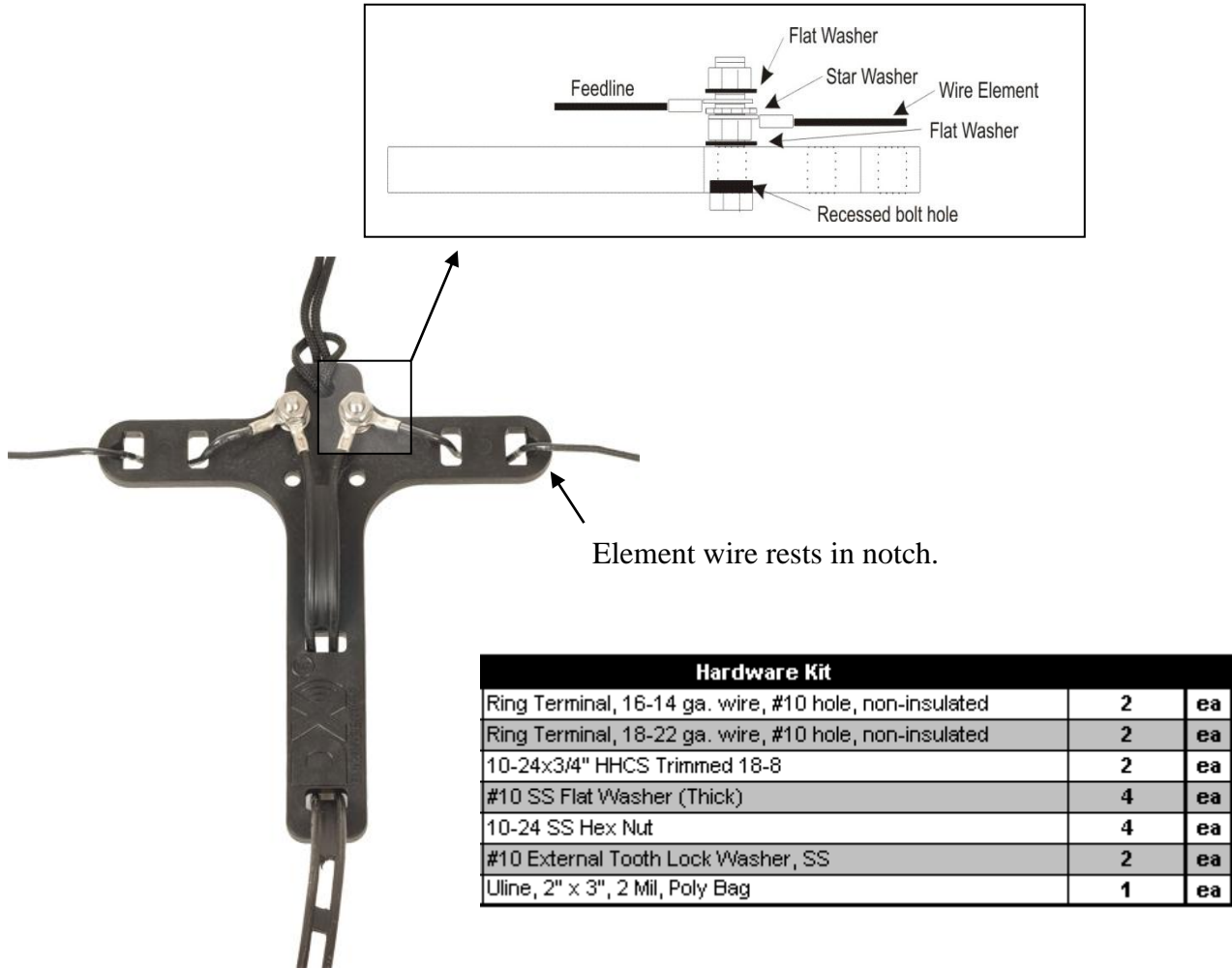


**Figure 1: Example of Antenna Mounting**

## Connection to Center-T Support

### Messenger Line

After determining the proper length needed, form a loop at the mid-point of the messenger rope. Push this loop through the center-T support top hole, then pull the rest of the rope through the loop. See **Figure 2**.



**Figure 2: Assembled Center-T Support, DX Engineering Logo Facing Up**

### Wire Elements

Install the hardware as shown in **Figure 2**. Note the recess for the bolt heads.

Install a 14 gauge wire lug to one end of each of the wire elements. Strip about 1/4 inch of insulation from the element wire and insert the wire into the crimp end of the wire lug, making sure the wire does not protrude from the crimp onto the ring surface. Crimping and soldering is suggested. Select one end of a wire element with a lug installed. Begin with one side of the center-T support with the DX Engineering logo on the center-T support facing up. Feed this element wire

down through the outer side rounded slot of the center-T support. Next, route this element wire back up through the inner slot and attach the wire lug to one of the upper terminals. These terminals will also be used for the feedline connection. Repeat the same process for the opposite side wire element. Remove the excess slack in the wire elements on the center-T support prior to putting up the antenna.

## Feedline

Install the 18 gauge wire lugs on one end of the feedline. Using the end with the lugs installed and with the DX Engineering logo facing up, route the feedline down through the lower slot, then back up through the upper slot, leaving just enough slack to permit connections to the upper terminals on the center-T support. Be sure to use the star washers between the feedline and wire element lugs as shown in **Figure 2**. Tighten the mounting hardware.

If you need additional feedline, the DX Engineering **DXE-LLC-1P** line coupler can be used to create a strong and consistent splice. See **Figure 3**.

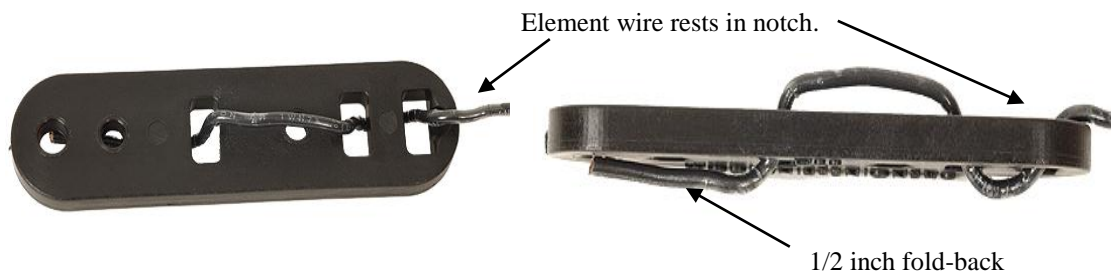


**Figure 3: DXE-LLC-1P Line Coupler**

## End-Insulators

### Connections

Feed the wire element through the end insulator (U.S. Patent No. D534905) as shown in **Figure 4**.



**Figure 4: End Insulator Wire Routing**



With the DX Engineering.com lettering facing down, and the notched edge of the end slot facing up, route the wire down through the notched end slot, back up through the next slot, then back down through the middle slot. Fold the end of the wire back away from the center of the bracket as shown. This fold-back length should be about 1/2 inch long. The careful design of the end insulators provides ample wire tension to prevent any slippage of the wire in the insulator after installation.

## Optional Items

### **DXE-400MAX Coax, 50 Ohm low loss RG-8/U type, PE jacket, UV resistant, direct buriable Specially manufactured for DX Engineering - Sold by the foot cut to your specified length.**

A premium, low loss 50 ohm coaxial cable with a special Type III-A UV-resistant polyethylene jacket which is ideal for any outdoor applications - particularly suited for direct burial. With its larger AWG #10 center conductor, this 50 ohm cable is specially suited for high-power amateur stations, it provides a lower loss solution for long cable runs at any power level. Gas Injected Foam Polyethylene dielectric. High reliability and long life are key elements in choosing this cable.

The highest level of shielding is assured by the bonded aluminum tape covered with a tinned copper shield braid.

**Mechanical Specifications:** Center Conductor: AWG #10, 19/.0210" Strand Bare Copper. Dielectric: Gas Injected Foam Polyethylene, OD: .285". Shield Tape: Bonded Aluminum - polyester - aluminum tape. Shield Braid: AWG #34 Tinned Copper, 95% coverage. Jacket: Black Low Density Polyethylene Direct Burial UV resistant. Jacket Dim: .044" thick. Nominal OD: .405". **Electrical Specifications:** Impedance: 52 ohms. Capacitance: 23.0 pF/foot. Velocity of Prop.: 84% (0.84)



### **DXE-213U Coax, RG-213/U MIL-SPEC, Type II-A non-contaminating PVC jacket, UV resistant, direct buriable**

A low loss 50 ohm MIL-spec coaxial cable with a non-contaminating Type II PVC jacket - UV-resistant and direct burial - which is great for all outdoor applications. Specially suited for high-power amateur stations, it provides a lower loss solution for long cable runs at any power level. Solid polyethylene dielectric. High reliability and long life are key elements in choosing this cable. Uses standard PL-259 connectors and N connectors for RG-8 size cables. **Mechanical Specifications:** Center Conductor: AWG #12.5, 7/.0296" Strand Bare Copper. Dielectric: Solid Polyethylene, OD: .285". Shield Braid: AWG #33 Bare Copper, 96% coverage. Jacket: Black PVC Type II Non-Contaminating. Jacket Dim: .045" thick. Nominal OD: .405".

**Electrical Specifications:** Impedance: 50 Ohms. Capacitance: 30.8 pF/foot. Velocity of Prop.: 66% (0.66)



### **DXE-8U Coax, RG-8/U Foam 50 Ohm low loss, PVC jacket**

A new low loss corrected 50 ohm coaxial cable with a black vinyl jacket and foam polyethylene dielectric. Specially suited for high-power amateur stations, it provides a lower loss solution for long cable runs at any power level. High reliability and low loss are key elements in choosing this cable. Uses standard PL-259 connectors and N connectors for RG-8 size cables. **Mechanical Specifications:** Center Conductor: AWG #11, 7 Strand Bare Copper. Dielectric: Gas Injected Foam Polyethylene, OD: .285". Shield Braid: AWG #34 Bare Copper, 95% coverage. Jacket: Black High Flex PVC. Jacket Dim: .047" thick. Nominal OD: .405". **Electrical Specifications:** Impedance: 50 ohms. Capacitance: 25.5 pF/foot. Velocity of Prop.: 81% (0.81)



**DXE-3M2155** - 3M Temflex™ 2155 Rubber Splicing Tape. Conformable self-fusing rubber electrical insulating tape. It is designed for low voltage electrical insulating and moisture sealing applications. For outdoor use, it should be protected from UV deterioration with an overwrap of **TRM-06133**



**TRM-06133** - Scotch® Super 33+. Highly conformable super stretchy tape for all weather applications. This tape provides flexibility and easy handling for all around performance. It also combines PVC backing with excellent electrical insulating properties to provide primary electrical insulation for splices up to 600V and protective jacketing. Both tape products are available from DX Engineering.



**DXE-LLC-1P Ladder Line Coupler** is used to consistently splice both 300 and 450 ohm ladder line by maintaining the spacing between the conductors. It includes a high-impact, insulated splice block, ring terminals and stainless steel hardware.

- High impact Black, UV resistant
- All Stainless Steel hardware
- Use one per splice.



**SYN-DBR** rope is available in 3/32", 1/8", 3/16", 5/16", and 7/16" diameter in various length rolls from DX Engineering. SYN Double-braided Polyester ropes are not weakened by decay or mildew and provide excellent resistance to abrasion. The color sealed black polyester yarn used in the braided jacket also protects the cord from damage due to ultra-violet light.



<b><u>SYN-DBR-94-100</u></b>	3/32 in. Diameter, Dbl-Braid Dacron/Polyester Rope, 100 ft. Roll
<b><u>SYN-DBR-125-100</u></b>	1/8 in. Diameter, Dbl-Braid Dacron/Polyester Rope, 100 ft. Roll
<b><u>SYN-DBR-187-100</u></b>	3/16 in. Diameter, Dbl-Braid Dacron/Polyester Rope, 100 ft. Roll
<b><u>SYN-DBR-187-350</u></b>	3/16 in. Diameter, Dbl-Braid Dacron/Polyester Rope, 350 ft. Roll
<b><u>SYN-DBR-187-500</u></b>	3/16 in. Diameter, Dbl-Braid Dacron/Polyester Rope, 500 ft. Roll
<b><u>SYN-DBR-312-100</u></b>	5/16 in. Diameter, Dbl-Braid Dacron/Polyester Rope, 100 ft. Roll
<b><u>SYN-DBR-312-500</u></b>	5/16 in. Diameter, Dbl-Braid Dacron/Polyester Rope, 500 ft. Roll
<b><u>SYN-DBR-437-500</u></b>	7/16 in. Diameter, Dbl-Braid Dacron/Polyester Rope, 500 ft. Roll

**Baluns - High Power Transmission Line Transformers and Baluns with Patented Maxi-Core™ Technology - DX Engineering** Baluns with Maxi-Core™ Technology let your antenna perform to its full potential and reduce the stresses on your equipment.

- Allow a better match from the coax impedance to the impedance of the antenna for lowest SWR
- Exhibit an increased operating bandwidth over other baluns
- Perform at the highest levels of efficiency in transmit or receive applications
- Allow use of an Antenna Tuner and High Transmitter Power without damage (DXE "T" Baluns only)
- Handle High Power (up to 10KW per published spec) with minimum energy loss
- Reduce RFI
- Mounted in sturdy Aluminum boxes with convenient mounting holes
- Unbalanced Output uses Teflon/Silver SO239 Connector
- Balanced Input uses Ceramic Insulators with Stainless Hardware



<b>DXE-BAL050-H05-A</b>	Balun - 1:1, 1.8 to 30 MHz, Formed Aluminum Enclosure (Wire Dipoles)
<b>DXE-BAL050-H10-A</b>	Balun - 1:1, High Power, 1.8 to 30 MHz, Formed Aluminum Enclosure
<b>DXE-BAL050-H10-AT</b>	Balun - 1:1, High Power, For Use With Antenna Tuner, (Special Applications)
<b>DXE-BAL050-H11-C</b>	Balun - 1:1, High Power, 1.8 to 30 MHz, Cast Aluminum Gasketed Enclosure
<b>DXE-BAL050-H11-CT</b>	Balun - 1:1, High Power, For Use With Antenna Tuner, (Special Applications)
<b>DXE-BAL100-H11-C</b>	Balun - 2:1, High Power, 1.8 to 30 MHz, Cast Aluminum Gasketed Enclosure
<b>DXE-BAL200-H10-A</b>	Balun - 4:1, High Power, 1.8 to 30 MHz, Formed Aluminum Enclosure
<b>DXE-BAL200-H10-AT</b>	Balun - 4:1, High Power, For Use With Antenna Tuner, (Special Applications)
<b>DXE-BAL200-H11-C</b>	Balun - 4:1, High Power, 1.8 to 30 MHz, Cast Aluminum Gasketed Enclosure
<b>DXE-BAL200-H11-CT</b>	Balun - 4:1, High Power, For Use With Antenna Tuner
<b>DXE-BAL300-H10-A</b>	Balun - 6:1, High Power, 1.8 to 30 MHz, Formed Aluminum Enclosure
<b>DXE-BAL450-H10-A</b>	Balun - 9:1 High Power - 1.8 to 30 MHz, Formed Aluminum Enclosure
<b>DXE-BAL600-H10-A</b>	Balun - 12:1, High Power, 1.8 to 30 MHz, Formed Aluminum Enclosure

**DXE-CSR8X-1** and **DXE-CSR213-1** are coaxial Cable Strain Relief kits especially designed to be used with DX Engineering Baluns. The **DXE-CSR8X-1** includes clamps for RG-8X coaxial cable and the **DXE-CSR213-1** includes clamps for RG-213 coaxial cable. Coaxial cable is heavy. If not properly restrained, the weight of cable can cause a failure in your feed line connection and in some cases, the cable can pull completely out of the PL-259 connector. The **DXE-CSR** Cable Strain Relief kits are designed with corrosion-resistant aluminum and use stainless steel hardware. These kits are very durable and will ensure cable strain is relieved to keep you on the air.



<b><u>DXE-CSR8X-1</u></b>	Cable Strain Relief Kit, For RG-8X
<b><u>DXE-CSR213-1</u></b>	Cable Strain Relief Kit, For RG-213

## 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](mailto: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.

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Specifications subject to revision without notice.

