Maxi-Core™
Special Line Transformers

DXE-BAL450-H10-B-P

DXE-BAL450-H10-B-P-INS Rev 0

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

Introduction

The DX Engineering Maxi-Core™ Special Line Transformers are designed to be used in the construction of an **ultra-low loss**, low cost, long length feedline system for 50-ohm HF antennas.

The model **DXE-BAL450-H10-B-P** consists of a pair of **DXE-BAL450-H10-B** high power 450-ohm balanced to 50-ohm unbalanced line transformers which may be used at each end of ***any*** length of 450-ohm parallel wire transmission line. This allows a cost-effective, **low-loss**, very long feedline to be created, to connect a 50-ohm HF transmitter or transceiver to a distant matched 50-ohm HF antenna system.

Using **Maxi-Core™ Technology**, the **DXE-BAL450-H10-B** Special Line Transformer is a heavy duty 450-ohm to 50-ohm current choke balun that operates from 1.8 MHz to 30 MHz. **Maxi-Core™ Technology** contributes significantly higher common mode impedance and a larger effective core area than similar designs made with conventional enameled wire or bead baluns. This results in:

- Higher power handling with lower loss – more power to the antenna
- Widest bandwidth – covers all amateur HF frequencies
- Reduced RFI – less interference to and from your radio

Additional construction benefits include:

- Internal DC shield ground and arc gaps improve lightning protection and reduce static
- Teflon® silver coax connector, ceramic output posts, stainless steel terminals, and rugged aluminum housing provide maintenance-free operation

Specifications

DXE-BAL450-H10-B-P Maxi-Core™ high power matching transformers include internal current chokes. They provide exceptional common mode current isolation between their 450-ohm balanced line terminals and their unbalanced 50-ohm coaxial cable connections over a wide frequency range. High common mode isolation from an internal choke, along with the carefully balanced matching transformer, significantly reduces stray signal reception and feedline radiation when compared to other less sophisticated matching methods.

- 1.8 MHz through 30 MHz
- 5 kW Continuous
- 10 kW Intermittent
- Formed aluminum case
- Top quality Teflon® SO-239 connector to connect the user supplied coaxial cable
- Ceramic insulators with stainless steel connection hardware for connecting to 450-ohm ladder line

Please Note: The designation "450-ohm" is conventional terminology in Amateur Radio, even though the specifications for 450-ohm ladder line can range from 380-ohms to 430-ohms. The **Maxi-Core™** Special Line Transformers were designed specifically for this application.

General Information

Some operators have access to moderately distant areas of land that may be ideal locations for many types of low SWR 50-ohm HF antenna installations. However, the distance between the station and the desired antenna system is too long, due to high cable losses, for the use of standard RG-8 or RG-213 type coaxial cables. Furthermore, the use of expensive, ultra low-loss helical and hardline coaxial cables can be very cost prohibitive.

The **DXE-LL450-5C** (500 foot spool) or **DXE-LL450-1K** (1,000 foot spool) 450-ohm ladder line, available from DX Engineering, also known as “window” type of parallel-wire transmission line, is readily available at a fraction of the cost of standard coaxial and larger flexible or hardline cables.

Specifically, balanced 450-ohm ladder line offers the major advantage extremely low RF loss as compared to standard coaxial cable, and can be properly installed over long distances much more easily than other feedlines.

The use of home-made or commercial open-wire feeder with "spreaders" is discouraged. Parallel open-wire impedance is difficult to maintain with the correct conductor separation over long lengths and the conductors are prone to shorting if installed with the proper axial twist. 450-ohm ladder line is constructed to assure constant spacing of the conductors and constant impedance over its length.

The RF power loss of 450-ohm ladder line is lower than the loss of all 50-ohm and 75-ohm commercial hardline and CATV hardline cables 7/8" and smaller, and is equal to the loss of 1-1/4" hardline! (Loss figures from *The ARRL Antenna Book*)

The loss of 450-ohm ladder line is typically 1/10 of the loss of RG-213. Depending upon feedline length and frequency of operation, power transfer and signal reception can be improved by 2 to 5 dB using **DXE-BAL450-H10-B-P** Special Line Transformers and **DXE-LL450-5C** or **DXE-LL450-1K** 450-ohm ladder line that represents an improvement of one and a half to over three times in system performance when transmitting.

Table 1 shows the Cable Loss in dB and approximate costs[1] of each 50-ohm feedline system is shown, compared to **DXE-BAL450-H10-B-P** Special Line Transformers and **DXE-LL450-5C** or **DXE-LL450-1K** 450-ohm ladder line.

Line	**RG-213 Belden 8267**		**Low-loss LMR-400DB**		**1/2” Heliax® LDF4-50A**		**7/8” Heliax® LDF5-50A**		**450-ohm Ladder Line (with DXE Special Line Transformers [2])**	
Line $/foot	$1.40/ft		$1.05/ft		$2.60/ft		$6.30		$0.49 or less	
Feet	dB	$US	dB	$US	dB	$US	dB	$US	dB[3]	$US
300	2.4	420.00	1.2	315.00	0.6	780.00	0.3	1890.00	0.6	446.95
500	3.0	700.00	2.0	525.00	1.0	1300.00	0.5	3150.00	0.7	544.95
1000	6.0	1400.00	4.0	1050.00	3.0	2600.00	1.0	6300.00	1.0	749.94

1. Approximate costs of these feedline systems are for the feedlines only and do not include connectors, trenching, feedline supports, or installation labor costs. Costs were estimated in August of 2009.
2. This approximate $US cost includes the 450-ohm ladder line and two **DXE-BAL450-H10-B** Special Line Transformers
3. Nominal insertion losses of 0.2 dB per Line Transformer is included

Table 1

The installation of long runs of low-loss coaxial transmission lines requires that a "Do-It-Youselfer" rent a trencher. Otherwise, the digging of the very long trench must be contracted with an excavation company, which can cost many hundreds and even thousands of additional dollars. Digging a trench for transmission lines is not feasible in steep or rocky land areas, and rigging such heavy cable at appropriate heights above the reach of animals would also be cost prohibitive.

Installation of a very long above-ground 450-ohm ultra low-loss feedline can be done at a reasonable cost by almost anyone. Using posts made of treated lumber, fiberglass, or by attaching the ladder line insulators to available trees, this type of long feedline system opens up new possibilities for those who own or have access to land, even in steep grade areas. Even if one were to contract the installation of this type of feedline supports with a fence company, using three to five posts per hundred feet and no fence material, the overall cost of a 450-ohm feedline system is much lower than equivalent low-loss coaxial transmission lines. Maintenance of 450-ohm ladder line is relatively inexpensive. In the case of damage from a major weather event, or due to a dozen or more years of exposure in a harsh environment, the repair or replacement cost of a new run of 450-ohm ladder line is well within any budget.

The 450-ohm feedline must be supported above ground by at least one foot and must not be covered with accumulated or drifting snow. It is recommended that the 450-ohm ladder line is installed above the reach of animals and riders, at about 8 to 12 feet above ground. Any influence from other wires or the ground is easily minimized by maintaining feedline separation of a few to several inches and by twisting the ladder line axially several turns per span. This also helps prevent wire fatigue, and reduces the amount of rain, snow and ice collecting on the feedline, which can have an effect on the impedance and loss of the system. According to the *ARRL Handbook for Radio Communications*, the 450-ohm feedline may be treated with some types of wax based products to minimize rain water collection and to speed the drying of accumulated rain or dew.

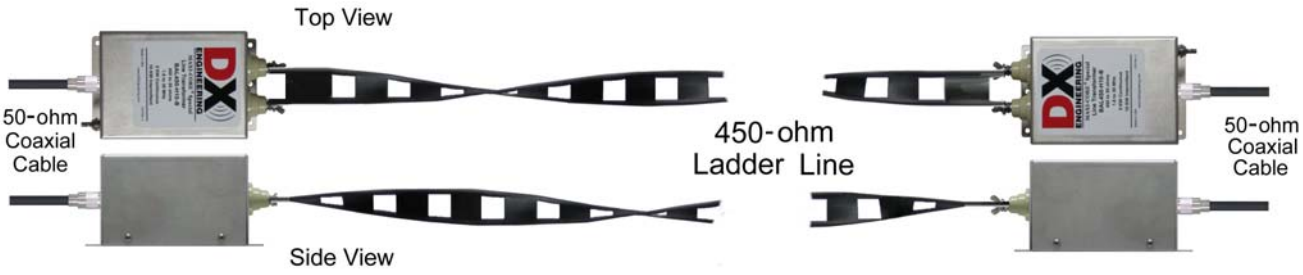


Figure 1 - Typical 450-ohm Ladder Line - Any length - Twisted

Figure 2 - Use of DXE-LL-INS Ladder Line Supports

This long length feedline system may be used with low SWR or matched 50-ohm antennas. Unmatched systems such as random length horizontal or vertical antennas should not be used, since any line transformer system would transform the wide variety of impedances across a wide frequency range to values beyond the reach of antenna tuners. However, matched, 50-ohm multiband antennas may be used. Only low SWR, 50-ohm antennas may be successfully fed at low loss using this 50-ohm unbalanced to 450-ohm balanced to 50-ohm unbalanced transmission line system.

Both balanced terminals are effectively **floating**, or **ground independent**, over the operating frequency of the special line transformers.

Connections

When making 450-ohm ladder line connections to the balanced terminals, it is recommended that you install ring terminals on the ladder line rather than just twisting the bare wire around the terminals. Using ring terminals will provide a longer lasting reliable connection.

Additionally, the use of a 3/8" open-end wrench is strongly suggested to hold the hex nut in place while you hand tighten the wing nut. This will prevent the 2-1/2" long hex bolt that goes inside the balun from rotating and possibly breaking an internal soldered connection.

The supplied wing nuts should be hand tightened only. Do not use pliers or other tools to tighten them as excessive force may damage the internal connections or the ceramic insulators.

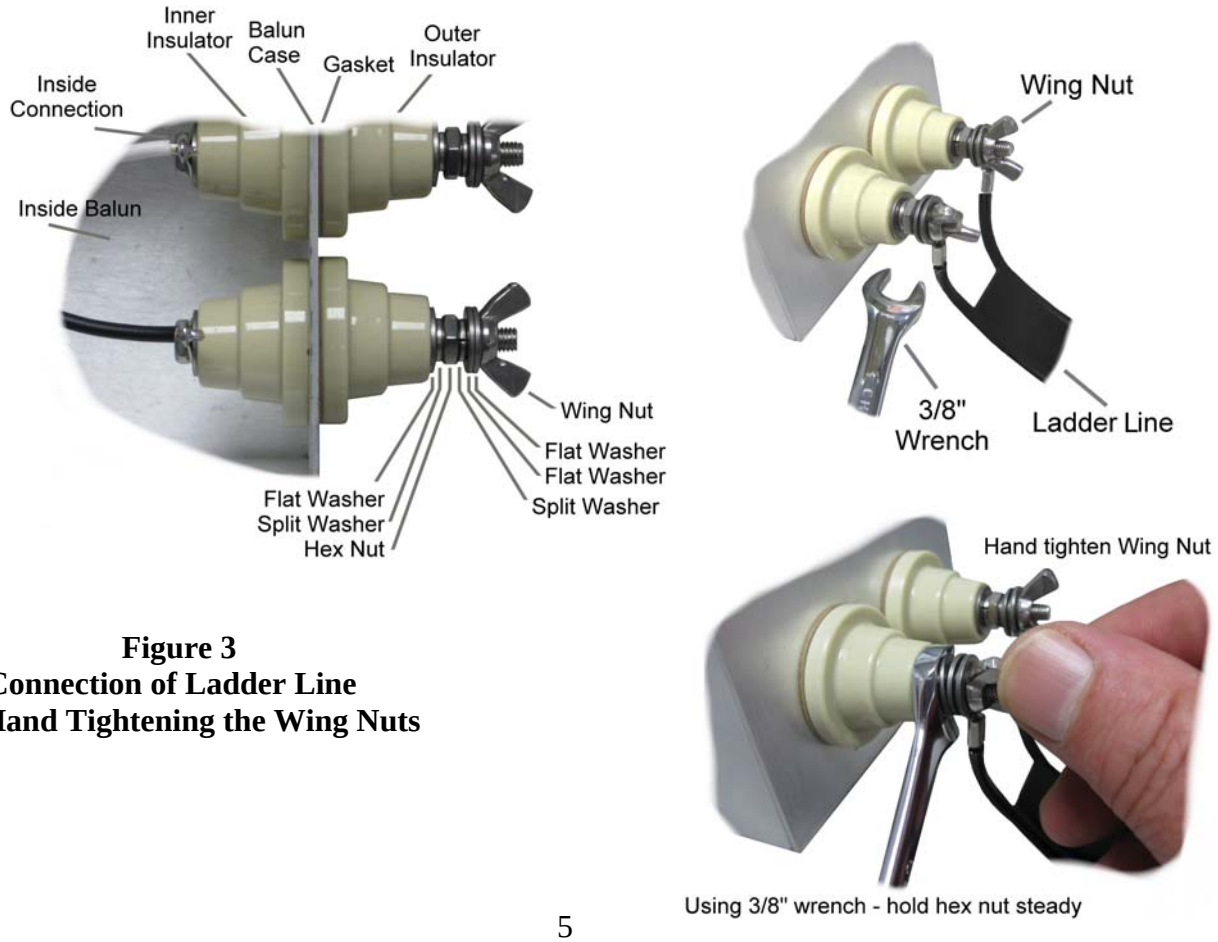


Figure 3
Connection of Ladder Line
and Hand Tightening the Wing Nuts

Installation

While the installation of this special line transformer is a simple process, there are a multitude of factors to consider when designing and erecting antenna systems. The antenna mounting height, proximity to structures, the feedline type, length and velocity factor are all factors that affect antenna performance.

Mounting

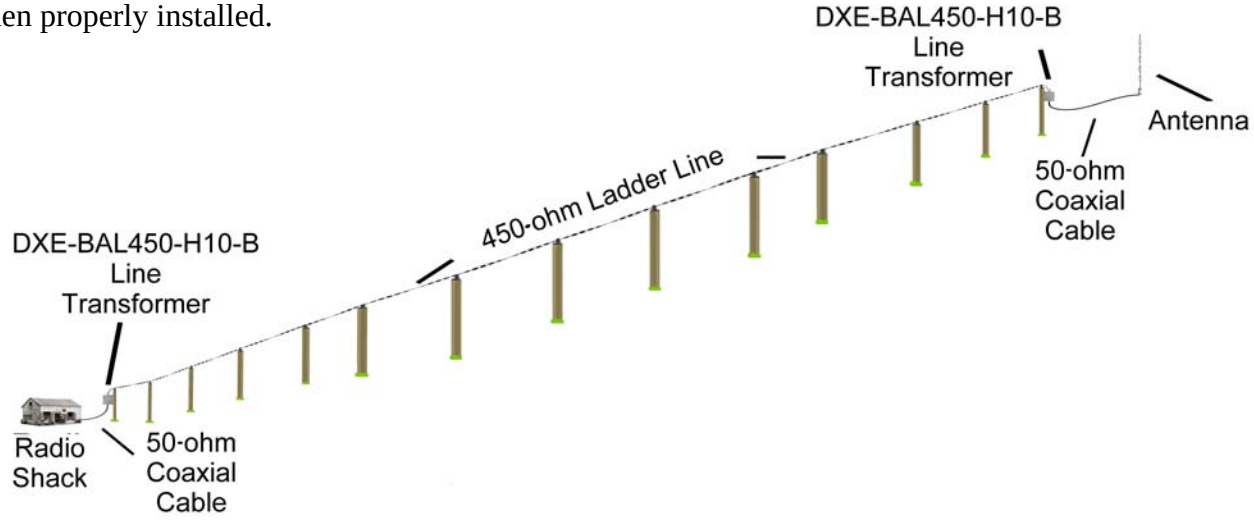
The **DXE-BAL450-H10-B** Special Line Transformers are manufactured with a formed aluminum enclosure. Although mounting is application specific, follow these general guidelines:

The **DXE-BAL450-H10-B** Special Line Transformers are not affected by moisture and may be left outside in all types of weather, including heavy rain, as long as the balun is positioned so that water will drain from the case. However, they may not be *immersed* in water and care should be taken to avoid blocking the drainage of any water that could get inside.

For most installations, weather-sealing of the formed aluminum enclosure balun is not required. If you chose to add weather-sealing to enhance weather resistance, it may be useful to put a bead of high quality, non corrosive, marine grade silicone **DXE-RTV598335**, along the top facing seam where the two halves of the case meet. Depending on the mounting orientation, leave a small opening in the seam at the lowest point to allow any condensation to drain. Silicone sealant which contains acetic acid, which has a vinegar-like smell, is corrosive to aluminum and should be avoided.

A high quality **DXE-PL259** Teflon® silver PL-259 connector on your coaxial cable is recommended. Be sure to weather-seal the coaxial connection with proper tape layers. Use **DXE-3M2155** rubber splicing tape and wrap the connector with one layer from end-to-end while stretching the tape by a factor of about 2:1. Follow with a wrap of **DXE-33PLUS** vinyl tape. Unlike some waterproofing solutions promoted to the Amateur market, the **DXE-3M2155** splicing tape can be easily removed at any time and will not permanently adhere to the fitting.

The DX Engineering **DXE-BAL450-H10-B** Special Line Transformers require no maintenance when properly installed.



Optional Items

DXE-LL450-1K - Ladder Line, 450-ohm - 1000 ft. Spool - DXE-LL450-1K
DXE-LL450-5C - Ladder Line, 450-ohm - 500 ft. Spool - DXE-LL450-5C
Transmit-quality 450-ohm ladder line for your antenna project when the feedpoint impedance is close to 400 ohms. It is also ideally suited for use with our Reversible Beverage Antenna, the RBS-1P. This quality line is constructed of 16 gauge conductors that are formed by 19 strands of 29 gauge copper-clad steel wire which provides the strength to hold up for long runs between supports. Actual impedance is nominally 400 ohms with a nominal velocity factor of 91%.

- 1000' or 500' Spools
- Conductor AWG (strand): 16 (19/29)
- Nominal Impedance: 400 ohms
- Velocity factor of 91%

DXE-LL-INS - 450-ohm Ladder Line Supports (25 per pack)
Top grade, UV stabilized, polyethylene ladder line supports designed for Beverage antennas that use 450-ohm line as the antenna wire, like the **DXE-RBSA-1P**.

- 25 Per Pack
- Easy to install
- Molded Pin Holds Wire or Ladder Line Tightly – Simply pull the pin to release.
- Fits Standard Wood Posts
- Heavy Duty Flange Holds insulator to Post
- Top Grade, UV Stabilized Polyethylene Prevents Arcing and Provides Long Life
- 5 Year Warranty

Balun, FCC & VFCC Mounting Kits Use one of these BMB kits to mount your DX Engineering Balun to the bottom of a vertical, the boom of a Yagi, antenna mast or a tower leg. Three different kits fit tubing or pipes from 3/4 in. to 3 in. The Dipole Adapter Bracket kit can be used as the center insulator of a dipole and allow a balun to be mounted right at the feedpoint. These kits will work with any DX Engineering balun.

DXE-BMB-1P	Balun Mounting Kit for a .750 in. thru 1.50 in. Boom
DXE-BMB-2P	Balun Mounting Kit for a 1.56 in. thru 2.25 in. Boom
DXE-BMB-3P	Balun Mounting Kit for a 2.31 in. thru 3.00 in. Boom

DXE-9551 - Replacement Ceramic Insulators
2 ceramic insulators for use with DX Engineering Baluns.
DX Engineering Baluns utilize 4 Ceramic Insulators per balun, however our replacement insulators are sold in pairs.

DXE-VFCC-BRKT - Balun or Feedline Current Choke Mounting Kit for HF Verticals -
This mounting kit allows you to mount a DX Engineering Balun or Feed Line Current Choke at the base of any vertical antenna. The polymer mounting plate is isolated from the rest of the vertical ground system for best performance and decoupling. The mounting bracket was designed to utilize one DX Engineering V-bolt Saddle Clamp DXE-CAVS-1P, to mount the bracket to a 1/2 - 1-3/4 in. ground pipe. Also available are the heavy duty DXE-CAVS-11P for 1/2 to 1-3/4 in. pipe and DXE-SSVC-2P for 1 to 2 in. pipe. The V-Bolt Saddle Clamps are not included and will need to be purchased separately if you choose to mount your bracket to a ground pipe. If, you are mounting to a 4x4 or 6x6 wooden post then no clamps are necessary; simply use (2) wood screws.
Works with any DX Engineering Formed Aluminum Enclosure
Kit includes:

- Polymer mounting plate and aluminum adaptor bracket
- Stainless steel mounting hardware

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 **DXE-33PLUS**

DXE-33PLUS - 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-RTV598335 - DX Engineering Approved RTV Sealant By Permatex

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

- 3.3 oz. Tube
- Black

*This part is classified hazardous and is limited to domestic UPS Ground shipping only

Technical Support

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

DXEngineering@DXEngineering.com

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

Warranty

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