

You've got to see our web site!

WEB Site

Join the fun at - <http://www.radioworks.com>

New! Full Catalog On-line

Now you can download the latest issue of our General Catalog and any forthcoming special interest catalogs. All of our publications on the net are in Acrobat PDF format for easy downloading. Also available will be copies of our product manuals and excerpts from Jim's books.

Sales - Monthly, last minute and clearance sales are featured.

Jim's Notebook - All sorts of useful information about antennas, plus many articles from the "Reference Catalog" and Jim's "Most Asked Questions" books are available here.

Links to other sites - Thousands of active links are available covering every facet of amateur radio. I've even included some of my favorite sites which have nothing to do with ham radio but are fun or useful.

Jim's Hamshack - It's a virtual tour of Jim's ever changing hamshack. I wonder what he'll do this time? You don't suppose that he'll finally go digital, do you?

There's lots more - It can take a couple of hours to see everything. There are more than 200 pages, but navigation is easy with lots of hypertext links.

A Note About Email

I try to answer your email promptly, but

It looks like I've finally solved my SPAM, virus, and worm problems thanks to "mailblocks" and "Cloudmark." I highly recommend "Cloudmark" and if you have problems with SPAM, take a look at what they offer. I don't have any connections with them other than using their product. I can say that I used to receive between 600 and 1000 SPAM emails per day. Now, it about 30 or 40. I'm saving a lot of time, and I'm using that time to answer your email messages. Still, there are times when I fall behind, sometimes as much as a week. This is now due to the sheer volume of email questions. I try to give everyone a correct and thorough answer. I'll get to every email message as quickly as possible.

Subject Line - I still have to read through the SPAM messages that get through. I don't want to miss your message, so be sure to put something that is easy to spot in the "Subject Line" of your message. Be specific. Things like, "need more information," etc. are typical SPAM subjects. If you write "CAROLINA WINDOM," tell me more," or "Catalog" or name a specific product, you'll be noticed. It's amazing how clever the SPAM'ers are these days with their "Subject Lines."

All outgoing messages are filtered. So, when you receive a message from me, it should be safe.

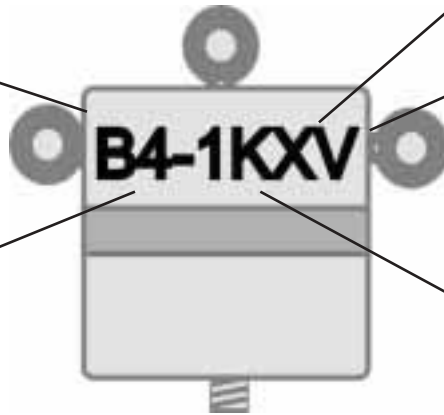
Don't send attachments. My SPAM filters will look very closely at attachments and often delete your message if anything looks suspicious.

I try to respond to all questions and other email correspondence quickly, but there can be delays. If you don't hear from me within a few days, usually less, send your message again. Let me hear from you.

BALUNS *Designators & Descriptions*

Case Type
 B - Standard balun case
 (Eye-bolts + SO-239 connector).
 Y - Yagi Applications, wire output

Ratio
 1:1 50-ohms in : 50-ohms out
 4:1 50-ohms in : 200-ohms out



Designator for "Twin Core," X-coupled or cross-coupled designs.

The "V" designator is for baluns designed for VHF operation

Power Rating
 500 = 500 watts
 1.5K = 1500 watts
 2 K = 2000 watts, etc.

Power is rated at 3.5 MHz unless otherwise specified. At 28 MHz, power may have to be derated if the load SWR exceeds 2:1. In all cases, power must be derated if the load SWR exceeds 3:1.

Power rating is for normal SSB or CW duty-cycles only.

As a matter of company policy, we do not endorse, nor support the use of amplifiers which exceed the legal power limit. However, we feel we must build antenna components that will withstand accidental misuse (i.e. tuning up on the wrong band). This is the only reason you will see baluns and Line Isolators with power ratings above the 1500 watt power limit.

BALUNS & LINE ISOLATORS

Why?

Have you ever wondered why other manufacturers won't publish their product's specifications? Do you suppose there is something they don't want you to know? We publish the numbers so you can choose the correct part for your application. You can count on the RADIO WORKS for the best baluns, antenna systems, and matching transformers.



1. True Current-type baluns and Line Isolators
2. Heavy-duty construction
3. Stainless-steel eyebolts
4. Eyebolts are not internally connected. This reduces receiver noise from the connection of dissimilar metals.
5. High voltage, high temperature wire
6. Massive ferrite cores
7. Unmatched specification
8. Wires from internal winding are brought outside the case for direct connection to your antenna.
9. There is no chance of poor connections.

The RADIO WORKS is *Baluns*

The **RADIO WORKS** introduced a full line of precision, 'Current-type' baluns several years ago. They were instantly popular because 'Current-type,' baluns avoid the bad habits that conventional 'Voltage-type' baluns exhibit. 'Voltage-type' baluns try to produce equal and opposite voltages at the balun's balanced port regardless of the load impedance. Since low impedance antennas are current fed, a balun that produces equal and opposite currents at its output over a wide range of load impedances is desirable. There is little to be gained by forcing the voltages of the two antenna halves, whether the antenna is balanced or not, to be equal and opposite relative to the ground side of the balun input. The antenna field is proportional to the currents in the elements, not the voltages at the feed point.

Current-type baluns are not a new idea.

They have been used in TV receivers for many, many years. TV tuners require a very wide bandwidth balun that will work with a severely mismatched antenna, like a TV's so-called 'rabbit ears' antenna. The Current-type balun was the best choice for that application.

Unfortunately, when baluns were first popularized for use with wire antennas, a voltage-type design was chosen because they are cheap and easy to make. Other balun makers just followed along. It was years before the first true, Current-type baluns appeared on the market.

Of course, times change and today you can find entire books devoted to Current-type baluns. Only The Radio Works was the first to offer you a full line of Current-type baluns for every application.

Misconceptions

1. Baluns will not improve SWR (the exception is when a balun used as part of a matching network, i.e. 4:1 baluns used in loops)
2. They are not lightning arresters, the winding inductance in most baluns is too low.
3. Built-in spark gaps don't work. The radio equipment is long gone before the 'gap' arcs over.
4. Baluns do not allow multiband operation of single band, coax fed antennas. Nor do they make antennas more broadbanded.

These are all generalizations and, of course, there may be specific exceptions to any of them.

A balun really has only two jobs

1. Isolate transmission line
2. Provide balanced output current

Proper Balun Design

A properly engineered balun will include these design points:

1. High winding inductance (reactance)
2. Low stray capacitance
3. Very short internal transmission lines- $\ll 1/4$ wave, the shorter the better.
4. High power components- high voltage wire and insulation to withstand high power or a mismatch.
5. Large wire gauge reduces I^2R losses.
6. Large cores - prevents saturation and provides the necessary inductive reactance values on the low bands.
7. Mechanical considerations: Weatherproofing, rustproof hardware and a strong case to withstand high physical loads.

Baluns

To insure the utmost in reliability, wires from the internal windings of the *B1*, *B4*, *Y1*, and *RemoteBaluns* are brought directly outside the case for connection to the antenna. This eliminates any chance of an unreliable connection. The trade-off is that the holes where these wires exit the balun's case must be sealed. CoaxSeal® is included with each balun and Line Isolator™ for this purpose and to seal the coaxial connector.

The transmission lines or the balun's windings are carefully designed for optimum impedance. The all-important wire used to make these internal transmission line(s) or other windings are insulated with a material similar to Teflon®. Top of the line models may use silver-plated wire and Teflon® insulation for maximum power handling and minimum power loss.

All 1:1 and some 4:1 models are Current-type designs. Current-type baluns are extraordinarily saturation resistant and provide superior reactance characteristics. Signal distortion and RFI due to core saturation is practically eliminated. Current-type baluns are very forgiving when feeding antennas that do not provide an ideal load.

Retrofit Line Isolators

A very useful application for Line Isolators is to install them in series with a beam antenna's normal feed system. The proper location is between the antenna's balun or matching device/system and the feedline. Doing this will not affect antenna matching unless the feedline is acting as part of the antenna. This is, of course, not a desirable situation and the installation of the Line Isolator will point out that a major problem exists with the antenna. In beam installations, where there is little interaction between the antenna and the feedline, using a Line Isolator in series with the antenna's feed system can substantially improve the antenna's front-to-back and front-to-side ratios. It does this by providing the antenna with balanced current at the feedpoint and by very effectively preventing the feedline from acting as part of the antenna. It is a seldom appreciated fact that ineffectively decoupled feedlines can act as efficient vertical antennas that can degrade an otherwise excellent radiation pattern. The addition of a Line Isolator or a proper balun can significantly reduce feedline radiation and dramatically decrease RFI and TVI. Beam antennas, especially, benefit from improved balanced drive and superior feedline isolation, but even simple dipoles benefit from properly selected and installed baluns and Line Isolators. Receiver noise also may be reduced by eliminating signal pickup by the feedline.

RemoteBalun™

With the RemoteBalun™, you can have the convenience of coaxial cable combined with the flexibility of open wire.

The *RemoteBalun*™ is a special, saturation resistant, Current-type balun capable of handling the legal power limit with loads of moderately high impedance.

Unlike other baluns, the *RemoteBalun* is designed specifically for antennas fed with open-wire, ladder line or twin-lead. The balun is conveniently located outside. A short length of low loss coaxial cable connects your transmatch (tuner) to the *RemoteBalun*. This eliminates the complication of routing balanced feeders into the radio room.

RFI Applications

Current-type baluns and Line Isolators are especially effective in reducing RF current on the outer surface of a coaxial cable's shield while having no effect on the signal carried within the cable. Current-type devices are singularly well suited to this application, because of several exceptional features that are not present in other balun designs. In the list of desirable characteristics is a very high load isolation over a very wide bandwidth, extremely low loss characteristics, and a wide, low SWR bandwidth.

1:1 Balun Specifications

<i>Model</i>	<i>B1-200</i>	<i>B1-2K Plus</i>	<i>B1-4K ULTRA</i>	<i>B1-5K Plus</i>	<i>Y1-5K Plus</i>
Type	Current	Current	Current	Current	Current
Ratio	1:1	1:1	1:1	1:1	1:1
Bandwidth	80 - 10 m	80 - 6 m	160 - 10 m	160 - 6 m	160 - 6 m
Coefficient of Coupling	100%	100%	100%	100%	100%
Power Loss in dB	Nil	Nil	Nil	Nil	Nil
Saturation resistant core?	Yes	Yes	Yes	Yes	Yes
Internal transmission line Z	50-ohms	50-ohms	50-ohms	50-ohms	50-ohms
Core type, ferrite	HF	HF/VHF	HF	HF/VHF	HF/VHF
L-C frequency compensation?	Not needed	Not needed	Not needed	Not needed	Not needed
Power Rating @ 3.5 MHz*	200 W	1500 W	4 kW	5 kW	5 kW
Output Balance	Excellent	Excellent	Excellent	Excellent	Excellent
Load variation tolerance	Excellent	Excellent	Excellent	Excellent	Excellent
Input connector	SO-239	SO-239	SO-239	SO-239	SO-239
Output connector	Wire	Wire	Wire	Wire	Wire
Eyebolts for wire attachment?	Yes	Yes	Yes	Yes	No, 1 on top for support
Physical Size	2.3" x 4.8"	2.3" x 8"	2.3" x 8"	2.3" x 8"	2.3" x 8"
Weight	6 oz.	14 oz.	16 oz.	14 oz.	16 oz.

* Power rating of HF baluns is based on a CW/SSB duty-cycle and an SWR of 3:1 or less at the output of the balun.

Plus models - On 50 MHz, power must be derated to 30% of the 3.5 MHz specification

PSK-31 is OK! - I've had many inquiries about using our antennas, baluns, and Line Isolators on PSK-31 since digital and other high duty-cycle modes are not recommended. Most operators of PSK-31 run low power to maintain low IMD. Any of our products are compatible with normal PSK operation.

Our baluns are not rated for AM, RTTY or other high power, high duty-cycle modes.

Eyebolts are stainless-steel and are not internally connected.
Specifications are subject to change without notice.

4:1 Balun Specifications

Model	B4-200	B4-1.5K	B4-2K	B4-2KX	RemoteBalun
Type	Voltage	Voltage	Voltage	Current	Current
Ratio	4:1	4:1	4:1	4:1	4:1
Bandwidth	80 - 10 m	80 - 10 m	80 - 10 m	160 - 10 m	160 - 10 m
Coefficient of Coupling	99%	99%	99%	99+%	99+%
Power Loss in	< .7 dB	< .8 dB	< .7 dB	< .8 dB	< .9 dB
Saturation resistant core?	Good	Excellent	Moderate	Excellent	Very Good
Core type	Ferrite	Ferrite	Ferrite	Ferrite	Ferrite
L-C frequency compensation?	No	Yes	Yes	Yes	Yes
Peak Power Rating @ 3.5 MHz*	200 W	1.5 kW	1.5 kW	1.5 kW	1.5 kW**
Output Balance	Good	Good	Good	Excellent	Excellent
Load variation tolerance	Good	Good	Good	Excellent	Excellent
Input connector	SO-239	SO-239	SO-239	SO-239	SO-239
Output connector	Wire	Wire	Wire	Wire	Wire
Eyebolts for wire attachment?	Yes	Yes	Yes	Yes	Yes
Physical Size	2.3" x 4.8"	2.3" x 8"	3.5" x 3.5"	3.5" x 3.5"	3.5" x 3.5"
Weight	6 oz.	12 oz.	12 oz.	16 oz.	18 oz.

* Power rating is based on a CW/SSB duty-cycle and an SWR of 3:1 or less at the output of the balun.

** May require derating under some load conditions.

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Line Isolator Specs

Model	T-4 & T-4G	T-4 & T-4G Plus	T-4-500	T-5G	T-6 & T-6G
Type	Current	Current	Current	Current	Current
Ratio	1:1	1:1	1:1	1:1	1:1
Bandwidth	160- 10	160 - 6 m	160 - 6 m	1.8 - 150 MHz	15 - 2 m
Coefficient of Coupling	100%	100%	100%	100%	100%
Power Loss in dB	Nil	Nil	Nil	Nil	Nil
Saturation resistant core?	Yes	Yes	Yes	Yes	Yes
Internal transmission line Z	50 Ohms	50 Ohms	50 Ohms	50 Ohms	50 Ohms
Winding Z @ 3.5 MHz	> 33 K	> 33 K	> 35 K	> 75 K	
Winding Z @ 14 MHz	> 80 K	> 80 K	> 75 K	> 50 K	>1.5 K @ 21
Winding Z @ 50 MHz		> 4 K (Plus)	> 20 K	> 1K	>1.6 K @ 150
Core type, Ferrite	HF	HF/VHF	HF	Multiple HF/VHF	VHF
Power Rating @ 3.5 MHz*	>1500 W	>1500 W	500 W	4 kW	1 kW @ 28 MHz
		200 W @ 6 m	100 W @ 6m	1 kW @ 6m	500 W @ 6m
Load variation tolerance	Excellent	Excellent	Excellent	Excellent	Excellent
Input connector	SO-239	SO-239	SO-239	SO-239	SO-239
Output connector	SO-239	SO-239	SO-239	SO-239	SO-239
Eyebolts for wire attachment?	No	No	No	No	No
Physical Size	2.3" x 8"	2.3" x 8"	1.5" x 4.5"	2.3" x 8"	2.3" x 7"
Weight	16 oz.	16 oz.	5 oz.	8 oz.	8 oz.

* Power rating is based on an SSB/CW duty-cycle and an SWR of 3:1 or less at the output of the Line Isolator. Specifications are subject to change without notice.

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Line Isolators are not rated for high power AM, RTTY other high power, high duty-cycle modes.

Eyebolts are stainless-steel and are not internally connected.
Specifications are subject to change without notice.

Baluns Just Aren't What They Used To Be ... Thankfully!

It seems like everyone thinks they can build baluns, and they make all sorts of incredible claims to prove it. We don't make claims. We print specifications.

Most commercially produced baluns are Voltage-type. The 'Current-type' balun is superior to simple 'Voltage-type' baluns in several ways. The most important differences are better output balance and higher feedline-to-antenna isolation. This means you enjoy improved antenna radiation patterns and fewer problems with TVI, RFI and RF feedback.

The RADIO WORKS' 'Current-type' baluns provide the ideal interface between unbalanced coax and balanced antennas. Of course, this is just what a balun is supposed to do.

We have learned a lot since we built the first C1-2K baluns in 1985. Those lessons have taught us how to make the incomparable RemoteBalun, the B1-4K Ultra, B1-5K, the B4-2KX, the T-4 and other Line Isolators[™]. Current-type baluns are now recognized as the best design. It is good to have had a major part in popularizing this important innovation.

Important - Power Ratings

All RADIO WORKS' products power ratings are for standard duty-cycle SSB and CW transmissions. We do not rate any of our products for high duty-cycle modes. This includes AM, RTTY and high duty-cycle digital modes. Essentially, these modes require devices designed for commercial service. It's either that or use low power levels. I have checked on prices for a commercial 2 kW baluns and the price was nearly \$1500. This is certainly beyond the range of most of our budgets. I know that there are some amateur radio baluns that claim power ratings of very high values. However, they say nothing about a duty-cycle ratings, nor the load conditions under which they will survive their rated power. I am being up-front with our ratings.

Power ratings are an interesting subject. It has been only during that past few years that the interest in very high power operation has been more than a very isolated case. We have been building baluns and Line Isolators for 20 years and our power ratings were solid as a rock. Most operators were using SSB and CW and still do. Then came the resurgence of AM operation and the apparent disregard of power limits. For example, an AM transmitter generating 1500 watts of carrier produces 6 dB higher output when fully modulated. In other words, the 1500 watt transmitter delivers 6000 watts of modulated RF to the antenna components. That's for a fully plate modulated carrier. The legal limit is 375 watts of carrier, by the way. 375 watts of carrier results in 1500 watts of plate modulated output.

The operating style of AM and many RTTY operators, especially when contesting or when just being long-winded, is to run key-down for long periods of time. The same goes for the new digital modes, too. There is no cool-down time for antenna components, and, at high power, they can overheat when stressed beyond their ratings.

Another problem with the popularity of using older transmitters which run "class-C" output stages. It is common for these transmitters to have a high harmonic and spurious signal content. Some antenna components, among them, high quality current baluns and Line Isolators, absorb much of the harmonic and spurious energy which results in core saturation and excessive heating. You may say that this doesn't happen in other types of devices. The reason is that these devices just pass the harmonics and spurious signals along to the antenna. This isn't to say that current baluns and Line Isolators can be used as "low pass filters." Their functions are different, and low pass filters and Line Isolators should be used together.

PSK-31

I often receive questions about the compatibility of PSK-31 and our products since I warn against high duty-cycle modes. The operating habits and power used by most PSK operators are perfectly compatible with our baluns, Line Isolators and antennas. IMD levels will not be elevated and the duty-cycle is not significant when running power below 100 watts on PSK.