



ALL ABOUT BALUNS

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WHAT IS A BALUN?

A transformer connected between a balanced source or load and an unbalanced source or load. A balanced line has two conductors, with equal currents in opposite directions. The unbalanced line has just one conductor; the current in it returns through a common ground or earth path.

WHAT DO TWINAX BALUNS DO?

Baluns are used to convert balanced signal connections to unbalanced wiring systems to replace expensive twinax cable with low cost twisted pair. They also allow you to connect workstations to 3X or AS/400 systems in a star-type topology.

IBM's Twinax cabling connections use a balanced signal. IBM specifies a twinax terminating impedance of about 110 Ohms $\pm 1\%$. When you use Twisted Pair wiring, the direct connections between the devices are lost. Therefore the balun needs to provide that same impedance. The resistor in the balun provides about 45 ohms. Twinax cable itself provides impedance as well. This combined with the other components provides the correct impedance.

WHAT IS IMPORTANT ABOUT CHOOSING & CONNECTING BALUNS?

Baluns can be either RJ11 or RJ45. These can not be mixed.

Sometimes baluns are defined using Tip and Ring terminology following the Universal Service Order Code - USOC standard. This is a set of codes developed by the Bell System and used as a standard means of identifying service or equipment. Typically the lower number connects to the ring. If it is the opposite, it is sometimes referred to as 'reversed'. This is not the best terminology to use in reference to Twinax baluns, because there simply is no standard for which pin inside the Twinax connector is Ring and which is Tip. Ring and Tip are really Coax cable terms, because that cable has a single conductor (Tip) in the middle of the cable and a shield (Ring). Twinax has two conductor pins. They are labeled phase A and phase B. There will be two signals; one connects to the Twinax phase A pin, and the other to the phase B pin, but since Twinax has two tips, and zero rings, you can not truly say that either pin is Tip or Ring. All that you can say is which pins are active, and which pins of the RJ connector connects to A or B of the Twinax connector. The signals can not be mixed when using baluns back to back.

Usually you use UTP (Unshielded Twisted Pair) if STP (Shielded Twisted Pair) cable, it must provide 110 ohms of impedance.

All the devices are terminated. The resistance between the Phase A and Phase B connectors must measure 110 ohms $\pm 5\%$. The resistance between Phase A and the Shield and between Phase B and the Shield must measure 55 ohms $\pm 5\%$. If either of these measurements is out of specification, the device is not terminated correctly and will not work reliably.

There must be some impedance provided by the wire or an internal resistor. If the twisted pair wire run is short, you can use twinax pigtails.

REQUIREMENTS:

- ❖ Balun pin-out must match at both ends.
- ❖ Never daisy-chain baluns.
- ❖ Never use in a series.
- ❖ No duplicate twinax station addresses.

RECOMMENDATIONS:

- Should be used in pairs when possible.
- Make certain wire color continuity is maintained end to end.
- Make certain tip and ring polarity is not reversed.
- Do not use flat (silver satin) cable. Only UTP.
- If using STP, it must have nominal impedance very close to 100 ohms.
- Allow a 10-foot service loop at each end to allow room to move the equipment easily and provide a minimum length of twinax cable to provide the expected cable impedance.
- Not more than 2/3 of the twisted pairs in a multi-conductor cable should be used for data.
- For each mechanical connection in a cable run, reduce the maximum allowed distance by 30 feet (9 meters).
- Avoid running data transmission wiring near sources of RF or electromagnetic radiation. Maintain the following distances:
 - 5 inches (125 mm) from a power line of 2 kVA or less.
 - 12 inches (305 mm) from fluorescent lighting and power
 - 36 inches (915 mm) from power lines more than 5 kVA.
 - 40 inches (1015 mm) from transformers and motors.
- Wire specifications:

Wire Size	AWG No. 24 or larger
Type	Solid copper, twisted pair wire with at least two twists per foot (six per meter)
Insulation	PVC (good) or Teflon (best)
dc Resistance, maximum	28.8 ohms per 1000 feet (93.8 ohms per 1000 meter)
Impedance	90 to 120 ohms at 256 kHz 87 to 117.5 ohms at 512 kHz 85 to 114 ohms at 772 kHz 84 to 113 ohms at 1000 kHz
Attenuation, maximum per 1000 feet (305 m)	4.00 dB at 256 kHz 5.66 dB at 512 kHz 6.73 dB at 772 kHz 8.20 dB at 1000 kHz
Industry Specifications (meet one)	ANSI/ICEA S-80-576-1983 REA PE-1 Bell System AT&T 48007

RECOMMENDED MAXIMUM TRANSMISSION DISTANCES:

Wire Gauge	DC Resistance Ohms/100 ft (ohms/100 m)	Ideal EMI environment ft (m)	Average EMI environment ft (m)	Poor EMI environment ft (m)
19	2.1 (6.9)	2050 (625)	1640 (500)	1230 (375)
22	3.3 (10.8)	2000 (610)	1600 (490)	1200 (365)
24	5.2 (17.1)	1575 (480)	1260 (385)	945 (290)
26	8.3 (27.2)	1050 (320)	840 (255)	630 (190)

HOW DO I KNOW WHAT MY EMI ENVIRONMENT IS?

Ideal EMI Environment applies where EMI is minimal.

Average EMI Environment applies to buildings having large quantities of computer cables routed throughout the building and/or coiled cables, wiring closets within the computer room and fluorescent lighting ballasts within 5 feet (1.5 m) of the twisted pair wiring. It includes twenty or more active FCC Class A devices, such as computers, monitors, heater fans and air conditioners.

Poor EMI Environment applies to large industrial plants having electrical transients of 330 to 400 kV, such as are produced by three-phase motors, welding equipment, auto-insertion equipment, air compressors, industrial ovens, large numbers of electrical motors, and combustion engines.

HOW DO I KNOW WHICH BALUN PINOUT I HAVE?

Technical Support will need the part number to find technical description of the balun. If you have a packing slip or invoice from Decision Data, you can find the part number there.

EXAMPLE: 301-2314-01 is BLN,NDI, ASF-11M-3/4

BLN is for balun.

NDI is for Network Devices Inc. (the origin of this balun).

ASF is Advanced System Filtering.

11 is RJ11.

M is male connector.

3/4 are the active pins.

(There would be an R if it were reversed).

WHAT DO I NEED TO KNOW ABOUT RJ TYPES?

RJ11 Short for Registered Jack-11, a four- or six-wire connector used primarily to connect telephone equipment in the United States. RJ-11 connectors are also used to connect some types of local-area networks (LANs), although RJ-45 connectors are more common.

RJ12 (a.k.a. 6-wire RJ11) modular phone connectors are used for all RS-232 communications. This has several advantages, including:

- All jacks have the same polarity, simplifying interconnection
- Routing can be easily changed using simple, compact distribution panels
- Signals may easily be tapped, for troubleshooting

RJ45 Short for Registered Jack-45, an eight-wire connector used commonly to connect computers onto a local-area networks (LAN), especially Ethernet. RJ-45 connectors look similar to the widespread RJ-11 connectors used for connecting telephone equipment, but they are somewhat wider.

POTENTIAL PROBLEMS:

1) RJ11 can be four or six wire. And because six pin is more common than four pin, when Nlynx states "pins 3&4 active of RJ11 versions", what they mean is 'the middle two pins'. The middle two pins for a six-wire connector are 3&4. But if you only had a 4-pin connector, then you would get 2 & 3.

2) Star products sometimes allow you to jumper select either the middle two, (referred to as 3 & 4, assuming a six pin connector) or the next two outside (which would be 2 & 5).

3) Baluns are often connected to 'Star' panels. Many people think that the Star panel will alleviate the need to observe Twinax Work Station Addressing rules, but they do not. The Twinax communication in these devices is passed through to the host. The end devices must all have unique WorkStation Addresses or you will have a conflict.

4) Some Star Panels, such as the Nlynx Gemini Active Star/RJ-45, pass the polarity of the pins through to the host. This means that the polarity of the host needs to match the polarity of the end devices. If none of the baluns on the device side work, then reverse the wires to the host. This can be done either in the Gemini Active Star/RJ-45 jumpers or with a different balun, or rebuild one end of the wire and flipping the two signals.

5) Sometimes you will find a scenario where only the first and last twinax devices work. This can be caused by an impedance mismatch. If the end device uses a T-cable, there is impedance in the T-cable. The end of the cable that connects to the brick at the host must match that impedance. In order to do this, either add a balun that has a twinax tail, or insert a 10-20 foot piece of twinax on the first part of the twinax run.

NLYNX Technologies GEMINI TWINAX BALUNS:

TWXBLN-11	Twinax to RJ11 filtered balun	301-2314-01
TWXBLN-45	Twinax to RJ45 filtered balun	301-2315-01
DB15-F11	Female DB-15 to RJ11 balun	301-2316-01
DB15-F45	Female DB-15 to RJ45 balun for emulation cards	301-2317-01
DB15-M11	Male DB-15 to RJ11 balun for IBM 34xx terminals	301-2318-01
DB15-M45	Male DB-15 to RJ45 balun for IBM 34xx terminals	301-2319-01

NLynx Technologies 3270 COAX BALUNS:

CTD-93C	CTD-93C; male BNC coax to RJ11, standard case	301-0085-01
CTD-93C-RJ45	CTD-93C-RJ45; male BNC coax to RJ45, std case	301-0085-03