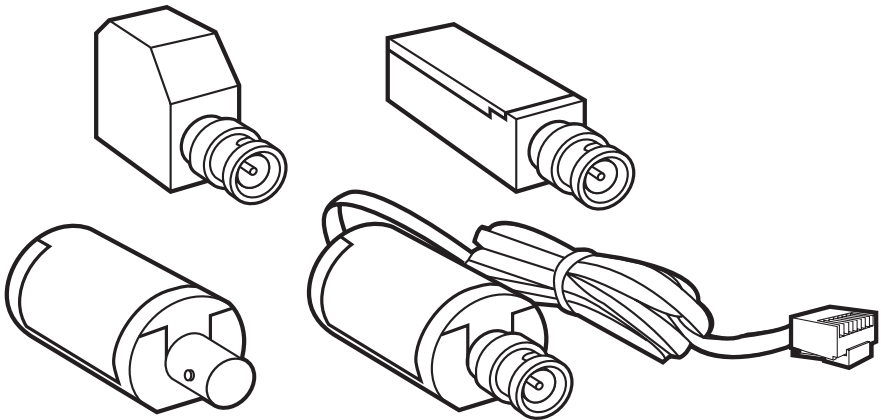




Coax↔Twisted Pair Balun
Coax↔Twisted Pair Balun w/cable
Mini Coax↔Twisted Pair Balun



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This equipment generates, uses, and can radiate radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This digital apparatus does not exceed the Class A limits for Radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique édicté par Industrie Canada.

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1. Specifications

System Environments — IBM 3270, ITT, Harris®, Memorex®, AT&T, Lee Data, and other Type A-compatible devices

NOTE: These baluns *cannot* be used in an Ethernet environment.

Connectors —

- IC002: (1) male BNC connector;
(2) screw terminals
- IC018A: (1) male BNC connector;
(1) male RJ-11 connector at the end of a 15-foot cable.
- IC019A: (1) male or female BNC connector;
(1) female RJ-11 connector
- IC033: (1) male BNC connector;
(1) female RJ-11 connector
- IC069A: (1) male BNC connector;
(1) female RJ-45 connector
- IC070A: (1) male BNC connector;
(1) female RJ-45 connector
- IC071A: (1) male BNC connector;
(1) female RJ-11 connector

Pin Configuration —

- IC002: Pins 3 and 4
- IC018A: Pins 3 and 4
- IC019A: Pins 3 and 4
- IC033: Pins 2 and 5
- IC069A: Pins 4 and 5
- IC070A: Pins 1 and 2
- IC071A: Pins 3 and 4

Data Format — 3270 Type A coax

Speed — 2.358 Mbps

Temperature — Operating: 32 to 131° F (0 to 55° C)
Storage: -4 to 185° F (-20 to 85° C)

Humidity — 95% non-condensing

Table 1. Data Transmission Parameters

Wire Gauge	Distance	DC Resistance	Capacitance
22	1500 feet	33 ohms/1000 feet	0.016 μ fd/1000 feet
	457 meters	33 ohms/305 meters	0.016 μ fd/305 meters
24	1200 feet	52 ohms/1000 feet	0.016 μ fd/1000 feet
	366 meters	52 ohms/305 meters	0.016 μ fd/305 meters

Power — None required

Size —

IC002: 0.6"W x 2.3"D (1.5 x 5.8 cm)
 IC018A: 1"W x 2.8"D (2.5 x 7.1 cm)
 IC019A: 1"W x 2.8"D (2.5 x 7.1 cm)
 IC033: 1.8"H x 1"W x 0.6"D
 (4.6 x 2.5 x 1.5 cm)
 IC069A: 1.8"H x 1"W x 0.6"D
 (4.6 x 2.5 x 1.5 cm)
 IC070A: 1.8"H x 1"W x 0.6"D
 (4.6 x 2.5 x 1.5 cm)
 IC071A: 1.8"H x 1"W x 0.6"D
 (4.6 x 2.5 x 1.5 cm)

2. Introduction

Coax-to-twisted-pair baluns allow a controller or host computer to communicate with peripheral devices over twisted-pair cables. Twisted-pair is easier to install and less costly than coaxial cable.

NOTE: These coaxial baluns *cannot* be used in an Ethernet environment.

Table 1 shows the maximum distance you can expect from twisted-pair cable. This maximum distance varies depending on the number of breaks and the type of wire used. The cable must be unshielded, low capacitance twisted pair. See **Section 3.2** for a full description and recommendations for your cabling. If you need to run your cable beyond the

recommended distance, you might be able to use a repeater.

The RJ-11 connection uses the naming convention of “tip” and “ring.” These are terms that have been passed down from the old telephone system. An operator would plug in a patch between two ports. The end of the plug (the “tip”) was the live connection. There was a black band around the plug for grounding. This was the “ring” line. Tip and ring have since become associated with a dial connection.

Since RJ-45 connectors do not use a dial connection there are no references to tip and ring when these connectors are used.

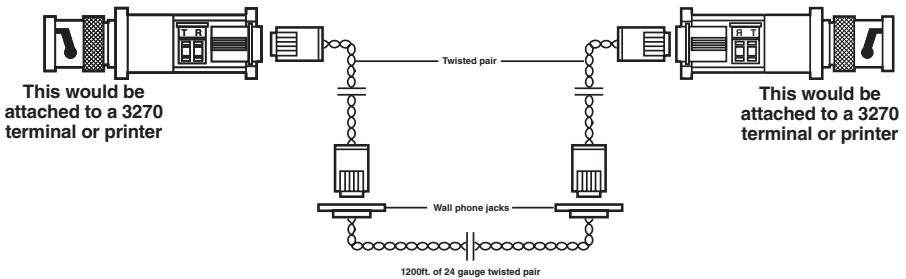


Figure 1. You can use the existing twisted-pair cable in your building when you install baluns.

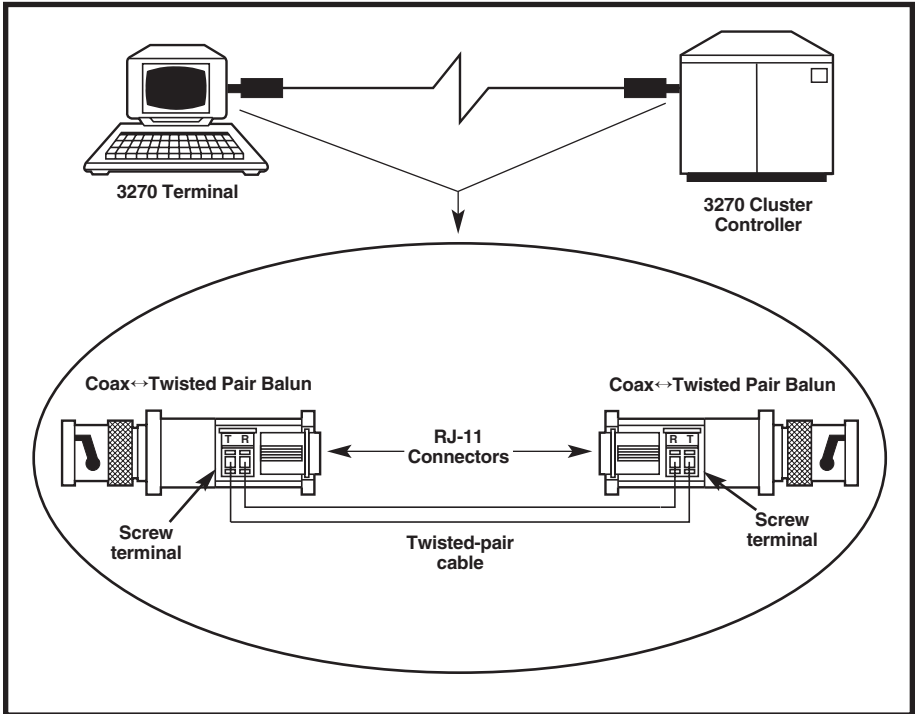


Figure 2. Typical installation for the Coax to Twisted Pair Balun (Single Port Configuration). A twisted-pair cable can utilize the screw terminal or the RJ-11 connector at either end. In this example, the screw terminals are utilized.

3. Installation, Operation, and Troubleshooting

3.1 Balun Installation

To install the balun, connect one end to the IBM® controller's coaxial port. Connect the other end of the balun to the twisted-pair cable with an RJ-11 connector, RJ-45 connector, or screw terminal (dependent upon which Balun you have purchased). At the other end of the communications link, connect the second balun to the device's coaxial port and to the twisted-pair cable. The cable must be wired straight-through.

3.2 Cabling

UNSHIELDED VS. SHIELDED TWISTED-PAIR CABLE

We recommend that unshielded cable be used to wire a building for data transmission. For optimal results, we recommend the use of EYN712A or its equivalent. The cable should be 24 AWG (or lower) solid copper twisted-pair unshielded cable that meets the following specifications:

Nominal Impedance:
100 ohms at 1 MHz

Maximum Capacitance:
20 pF/foot

Maximum Attenuation:
6.6 dB/1000 ft. at 1 MHz

If you are using unshielded cable that does not have the electrical characteristics specified above, the distances listed in Table 1 may be lower.

Shielded cable is not recommended because it usually has high nominal impedance. This may create impedance mismatch on the line.

When using a shielded cable, the shield must be grounded from one end of the connection to the other. If this is not done, the shield will act as an antenna and pick up electromagnetic or radio-frequency interference.

Unless you are using low-capacitance shielded wiring, your cable will have a much greater capacitance than 20 pF/foot, resulting in greater signal attenuation and shorter distance capability. Maximum attainable distance for shielded cable is a third of its rated distance.

SOLID COPPER VS. STRANDED WIRES

We suggest the use of solid copper over stranded wire because stranded wire has a capacitance higher than 20 pF/foot. The capacitance of stranded wire is, however, lower than that of shielded cable. The use of stranded cable is acceptable, but it will not be as efficient as solid copper wire for achieving maximum distances.

FLAT RJ-11 CABLE

The use of flat satin cable (telephone extension cords) is recommended only for patching purposes. When flat cable is used, maximum length between the controller and any terminal should not exceed 15 feet (4 m). If possible, try to use twisted-pair wiring instead of flat cable. Flat cable is not considered to be a reliable transmission medium.

IBM TYPE 1 AND 2 CABLE

With these baluns, you cannot convert coax cables to IBM Type 1 and 2 cable.

USE OF RISER CABLES

When you use riser cables containing more than 25 pairs, we recommend that these be arranged in binder groups. Each group should have a maximum of 25 pairs. This will minimize crosstalk between the different pairs.

Do not split pairs when making connections. A pair is two wires that share the same colors. For example, White-base and Blue-band wire form a pair with Blue-base and White-band wire.

CABLE LENGTH EVALUATION

For every connection a cable passes through, there is often a slight loss of signal strength. Such connections include 66 blocks and patch panels. Each connection subtracts approximately 10 feet from the maximum attainable distance.

The following equation can be used to estimate the effective length of a twisted-pair run:

$$C = A + (B * 10 \text{ feet})$$

Where:

A = Physical length of cable in feet
 B = Number of breaks in the cable loop
 C = Effective cable length for the system in feet

For example, if you wish to run 30 feet of cable (A) and have 7 connections in the cable loop, the effective length for the system would be 100 feet.

$$C = 30 + (7 * 10 \text{ feet})$$

3.3 Common Cable Problems

This section outlines the common errors associated with wiring cable:

- incorrect pinouts
- reverse signal polarity
- loss of continuity
- interface problems

MODULAR JACK PIN-OUT

Figure 3 illustrates modular jack pin-out conventions for RJ-11. The standard is Pin 3 for Ring and Pin 4 for Tip. This is a straight-pinned cable.

Telephone wiring systems usually take Pins 3 and 4 for voice and data transmission. Some wiring systems, like ROLM®, use Pins 3 and 4 for voice and Pins 2 and 5 for data so as to prevent a user from accidentally plugging a data terminal into a voice line and damaging the equipment.

It is important to verify that the pin configuration of the baluns corresponds to the pin configuration used in the building's wiring scheme.

Figure 4 illustrates modular jack pin-out conventions for an RJ-45 straight-pinned cable.

POLARITY PROBLEMS

Baluns are polarity sensitive. Cables must be wired straight-through as in Figure 3 (Tip to Tip and Ring to Ring) and Figure 4. Data will not be transmitted if there are crossovers on the cable. If your terminal will not work, and distance is within specified limits, try reversing Tip and Ring at one of the baluns.

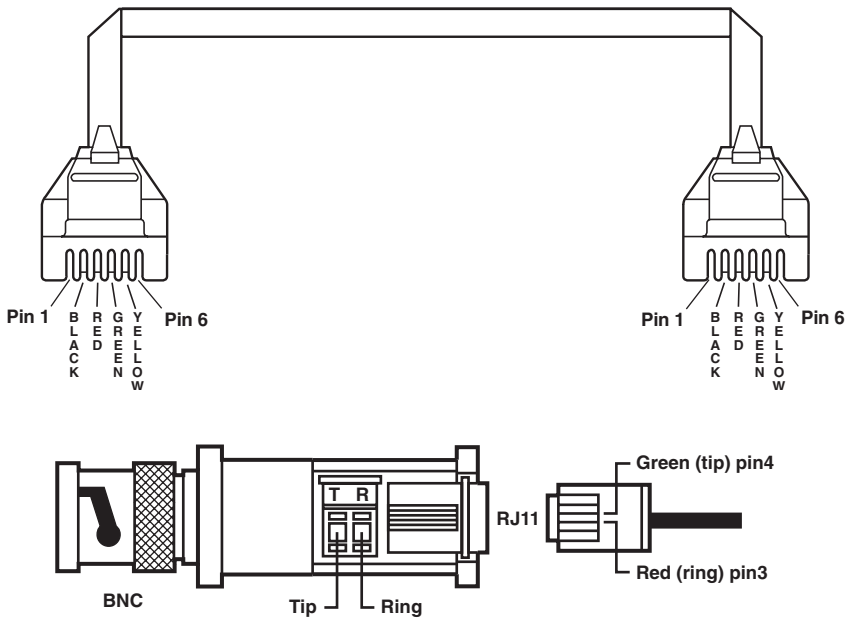


Figure 3. Modular jack pin-out conventions for RJ-11.

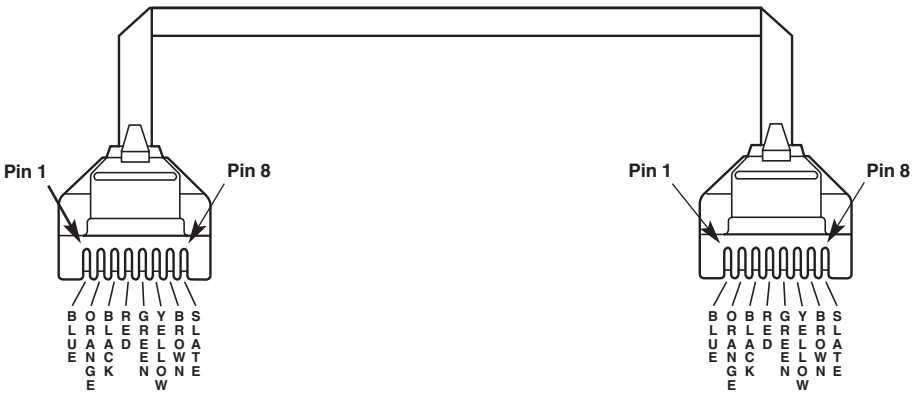


Figure 4. Modular jack pin-out conventions for RJ-45.

DC LOOP RESISTANCE TEST

One way to verify the continuity of your link is to perform a DC Loop Resistance Test. This will tell you if you have exceeded the total distance for your cable or if your link is bad (short circuits, open circuits, loose connections, or badly crimped connectors, etc.). Figure 5 shows

how to perform the DC Loop Resistance Test with the help of a multimeter set at the Ohm position. Make sure that the two wires at the opposite end of the the multimeter are shorted together. Table 2 illustrates the different resistance values for various cable types and distances.

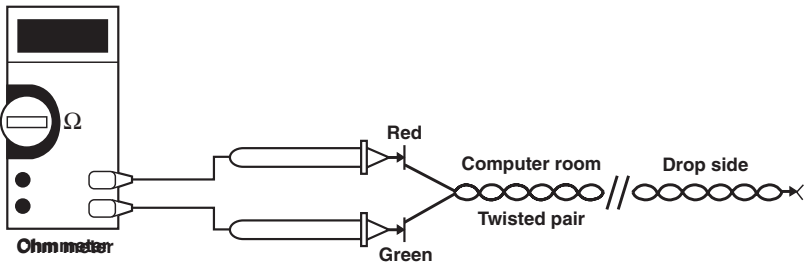


Figure 5. DC Loop Resistance Test.

Table 2. Typical Cable DC Resistances

Cable Size	DC Resistance per 1000 feet	DC Loop Resistance (Ohms)				
		600'	1200'	2400'	3000'	3500'
22 AWG	16.0 Ohms	19	38	77	96	112
24 AWG	26.0 Ohms	31	62	125	156	182

NOTE: Baluns do not maintain DC continuity. If an ohmmeter is used, the balun will appear to be shorted from Tip and Ring. The coax pins will also appear to be shorted. This is normal.

INTERFERENCE PROBLEMS

When installing cable, try to avoid all sources of electromagnetic interference such as fluorescent lighting, high power lines, electric motors and power transformers.

Data wiring should be at least:

- 5" (12.7 cm) from power lines of 2 KVA or less;
- 12" (30.5 cm) from fluorescent lighting and power lines between 2 and 5 KVA;
- 36" (91.4 cm) from power lines greater than 5 KVA;
- 40" (101.6 cm) from transformers and motors.

3.4 Troubleshooting

GENERAL TROUBLESHOOTING

Data transmission in the IBM 3270 environment is done via Manchester encoding at a frequency of 2.358 Mbps. At the output of the controller and the terminals, the amplitude of the signal is 2.5 Vp-p. For the controller to decode the terminal signal (and for the terminal to decode the controller signal), the minimal amplitude required is 500 MVp-p at each end.

In case of data transmission problems, refer to the following checklist:

- Are the controller ports working correctly?
- Are the data terminals working correctly?
- Has the cable distance been exceeded?
- Is signal polarity reversed?
- If an oscilloscope is available, is the signal from the controller at least 500 MVp-p at the terminal side?

TROUBLESHOOTING IN THE 3270**ENVIRONMENT**

Check the following when installing baluns in the IBM 3270 environment:

1. Signal polarity reversal: Switch the wires on the RJ-11 connector or on the hardwire (screw-type) terminals at one end of the line. Make sure the cable is straight-pinned (tip to tip, ring to ring). See Figures 3 and 4 on pages 10 and 11.
2. Verify that twisted-pair wires are connected to the correct pins of the balun. Check the pin configuration and correct if necessary.
3. Check for and eliminate open or short circuits on the line.
4. Exceeded distances: To verify if distance is being exceeded, a DC Loop Resistance Test should be performed (see **Section 3.3**, pages 11 and 12, for a full explanation).



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