

# Wired for Success

Coaxial Cables, RF Connectors, and Power Connectors in  
Amateur Radio

# Cables

## The Backbone of Communication

**Foundation of Functionality:** Coaxial cables, connectors, and Anderson Powerpole connectors form the essential infrastructure for effective amateur radio operations, ensuring clear communication and system reliability.

**Quality Connections:** Using the right coaxial cables and connectors is crucial for maintaining signal clarity and strength, minimizing loss, and avoiding interference.

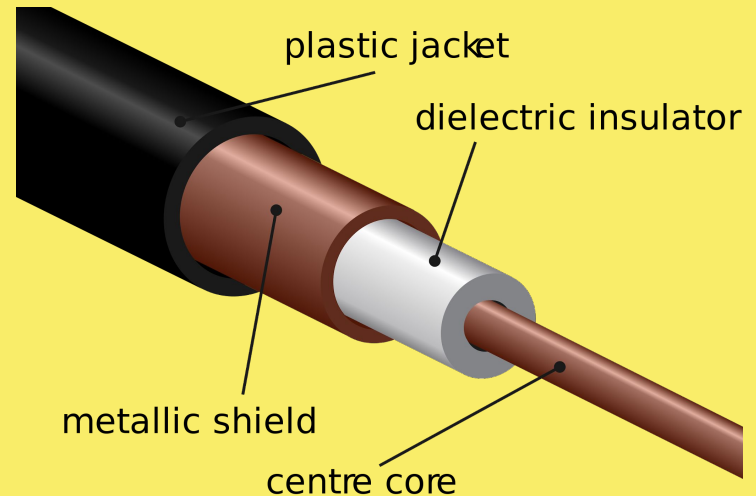
**Ready for Anything:** Different types of connectors and cables are suited to various environments and setups, from mobile stations to outdoor rigs. Understanding these differences ensures your equipment is both adaptable to any situation and durable against environmental challenges.

**Power and Performance:** Proper selection of connectors and cables impacts power handling, preventing equipment damage and optimizing performance for high-power transmissions and diverse operational needs.

# Core Connections: Mastering Coaxial Cables

## Coax basics:

- Plastic outer jacket
  - This can be PVC or other material
  - Not are are UV or direct burial rated
- Metallic Shield
  - This come in many forms usually a woven/braided wire shield
  - Double shielded will have a second shield either a second braided or foil
- Dielectric Insulator
  - Made from solid polyethylene (PE) and Teflon (PTFE) are common
- Center Core
  - Can be both solid or stranded

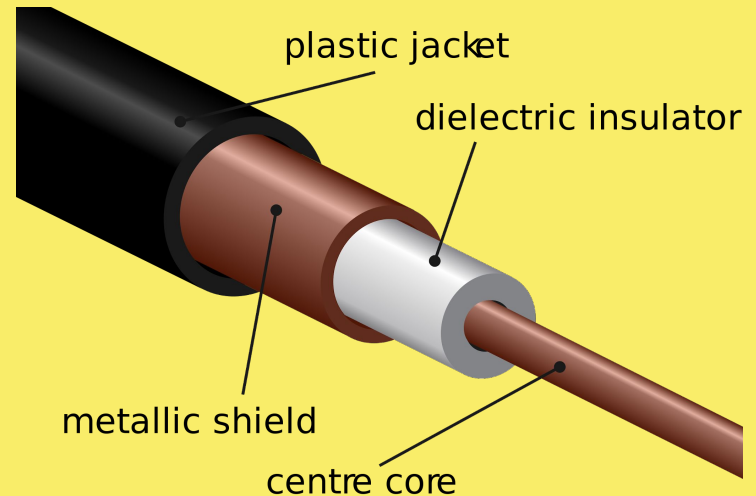


# Core Connections: Mastering Coaxial Cables

## RG-8x:

The most common type of coaxial cable used in amateur radio applications. It has a frequency range of up to 400 MHz and 50 ohm impedance, making it suitable for HF applications. The cable is made up of a copper-clad steel conductor, a foam polyethylene insulator, and a braided shield.

RG-8 cables are available in both solid inner conductor or stranded versions, with the stranded version offering greater flexibility. They are also available in different grades, with higher grades offering better performance and greater shielding.



# Core Connections: Mastering Coaxial Cables



## RG-58

The RG-58 coax cable is similar to the RG-8, but with a higher frequency range of up to 1 GHz. It has an impedance of 50 ohms, making it suitable for a wide range of applications. The cable is made up of a copper center conductor, a foam polyethylene insulator, and a braided shield.

RG-58 cables are available in both solid wire and stranded wire versions, with the stranded version offering greater flexibility. They are also available in different grades, with higher grades offering better performance and greater shielding.

# Core Connections: Mastering Coaxial Cables

## RG-213

The RG-213 coax cable also has a frequency range of up to 1 GHz and an impedance of 50 or 75 ohms. It has a solid copper conductor, a polyethylene dielectric, and a braided shield.



RG-213 cables are available in different grades, with higher grades offering better performance and good shielding. They are also available in both solid and stranded wire versions.

One situation where you might want to choose RG-213 cable over other options is if you need a cable that can handle high power levels. This makes RG-213 a good choice for high-power applications such as with the use of amplifiers and transmitters.

# Core Connections: Mastering Coaxial Cables

## LMR-400

The LMR-400 cable is a high-performance coax cable that is suitable for a wide range of applications. It has a frequency range of up to 6 GHz and 50-ohm impedance. The cable is made up of a solid copper center conductor, a foam polyethylene dielectric, and a double-braided shield. They are available in both solid and stranded versions.

One situation you'd choose LMR-400 cable over other options is when you need to transmit signals over a long distance. LMR-400 has lower loss per foot than other types of coax cable. It can maintain signal strength over a greater distance. Additionally, LMR-400 is able to handle higher power levels than other cables, making it a good choice for high-power applications.



# Choosing the Right Coaxial Cable: Key Factors

**Match Your Needs:** Different cables support various frequency ranges. Ensure the cable you choose matches the frequency needs of your operations to maintain effective transmission and reception.

**Consistent Performance:** Most amateur radio setups use 50 ohm cables. Matching the impedance of your cable with your radio and antenna system is crucial to avoid signal reflection and power loss.

**Minimize Attenuation:** Longer cables typically result in greater signal loss. Opt for the shortest possible cable that suits your setup to reduce attenuation and maintain signal strength.



# Choosing the Right Coaxial Cable: Key Factors

**Reduce Interference:** Cables with good shielding protect against external noise and interference, ensuring clearer signals. Consider cables with multiple shielding layers if you operate in a high-interference environment.

**Secure Connections:** The type of connectors on your coaxial cable should be compatible with your other equipment. Common types include PL-259, N-Type, and SMA, each offering different benefits for connectivity and performance.

**Built to Last:** Choose cables with UV-resistant jackets if used outdoors to prevent degradation. For underground installations, opt for cables rated for direct burial.

# Understanding Attenuation: Navigating Signal Loss

Signal loss in coaxial cables, also known as attenuation, is an important consideration when setting up amateur radio equipment. It refers to the reduction in strength of the radio signal as it travels through the length of a coaxial cable. Several factors contribute to signal loss:

**Cable Length:** The longer the cable, the greater the signal loss. Signal strength decreases with increased cable length due to the resistance within the cable which dissipates some of the signal as heat.

**Frequency of Operation:** Higher frequency signals tend to have higher loss. This is because higher frequencies face greater resistance in the cable material itself, which can absorb or reflect more of the signal.

# Understanding Attenuation: Navigating Signal Loss

**Cable Type:** Different types of coaxial cables have different levels of attenuation. For instance, thicker cables like RG-213 or LMR-400 typically have lower loss compared to thinner cables like RG-58. Each cable type is designed with specific materials and construction methods that impact its ability to carry signals efficiently over various distances and frequencies.

**Construction and Materials:** The materials used in the cable's construction—such as the type of shielding, the conductor, and the dielectric—also affect signal loss. For example, cables with solid copper conductors generally perform better than those with copper-clad steel conductors.

**Environmental Factors:** External conditions such as temperature and humidity can influence signal loss. Cables exposed to higher temperatures may experience slightly increased loss due to changes in the resistance of the materials used in the cable.

Coax Type:	Frequency:	Loss per 100ft:
RG-58	100MHz	6 dB
RG-8X	100MHz	4 dB
RG-213	100MHz	2.5 dB
LMR-400	100MHz	1.5 dB

Comparison of signal loss by cable type

# Linking Up: Exploring Key Connectors



Connectors are crucial in amateur radio setups as they ensure reliable and efficient transmission of signals between equipment. They serve as the critical junctions that must maintain the integrity of the signal by minimizing losses and preventing impedance mismatches, which can significantly degrade communication quality.

# Linking Up: Exploring Key Connectors

## PL-259 Connector

### Overview:

- **Design:** The PL-259, also known as a UHF connector, features a screw-type coupling mechanism which provides a robust and durable connection.
- **Frequency Range:** Suitable for applications up to 300 MHz, making it a common choice for HF and VHF frequencies in amateur radio.
- **Impedance:** Typically rated at 50 ohms, which is standard for the majority of amateur radio applications.

### Applications in Amateur Radio:

- PL-259 connectors are extensively used for connecting antennas to radios, especially in mobile and base station setups.
- Often paired with the SO-239 socket, it is commonly found on coaxial cables like RG-8 and RG-58 used in HF and VHF operations.



# Linking Up: Exploring Key Connectors

## PL-259 Connector

### Advantages:

- **Durability:** Known for its sturdy design suitable for environments where robustness is required.
- **Ease of Use:** The screw-type mechanism makes it relatively easy to connect and secure without special tools.

### Considerations:

- Limited to lower frequency use, making it less ideal for UHF applications where connectors like the N-Type might be more suitable.



# Linking Up: Exploring Key Connectors

## N-Type Connector

### Overview:

- **Design:** N-Type connectors feature a threaded coupling mechanism that ensures a reliable connection suitable for higher frequencies.
- **Frequency Range:** Capable of operating up to 11 GHz, thus providing good performance in higher frequency bands.
- **Impedance:** Commonly available in both 50 ohm and 75 ohm versions, allowing flexibility depending on the application.



### Applications in Amateur Radio:

Used in base station setups for antenna connections, especially where higher frequencies are involved.

Suitable for applications that require a durable connection capable of withstanding environmental exposure.

# Linking Up: Exploring Key Connectors

## N-Type Connector

### Advantages:

**High Frequency Performance:** Excellent for high frequency transmissions, making it suitable for microwave communications.

**Weather Resistance:** Often comes with weather-resistant designs for outdoor installations.

### Considerations:

More complex to install than simpler connectors like the SMA or BNC due to its larger size and threading mechanism.





# Linking Up: Exploring Key Connectors

## BNC Connector

### Overview:

- **Design:** BNC (Bayonet Neill-Concelman) connectors use a bayonet style locking mechanism that provides a quick and secure connection.
- **Frequency Range:** Typically used up to 4 GHz, making them suitable for a wide range of applications, including VHF and UHF.
- **Impedance:** Typically comes in 50 ohm and 75 ohm versions, catering to different types of radio and video applications.

### Applications in Amateur Radio:

- Commonly found in test equipment, portable radios, and antennas where frequent disconnection and reconnection might be necessary.
- Preferred for quick connect/disconnect scenarios such as in field operations or portable setups.



# Linking Up: Exploring Key Connectors

## BNC Connector

### Advantages:

- **Quick Connect/Disconnect:** The bayonet mechanism allows for rapid mating and un-mating, which is advantageous in dynamic operational environments.
- **Versatility:** Widely used across various electronic and radio applications due to its ease of use and reliability.

### Considerations:

- Not as robust as N-Type or PL-259 connectors for outdoor or rugged environments, and may not perform as well at the higher end of its frequency range compared to more specialized connectors.



# Linking Up: Exploring Key Connectors

## SMA Connector

### Overview:

- **Design:** SMA connectors are compact and feature a screw-type coupling mechanism which provides a secure and stable connection.
- **Frequency Range:** They are suitable for applications up to 18 GHz, making them ideal for microwave applications.
- **Impedance:** Standard SMA connectors are typically rated at 50 ohms, aligning with the common impedance requirements in amateur radio.



### Applications in Amateur Radio:

- SMA connectors are often found on handheld radios and smaller equipment where space is limited.
- Due to their high frequency capability, they are also used in Wi-Fi antenna systems, RF amplifiers, and other high-frequency applications.

# Linking Up: Exploring Key Connectors

## SMA Connector

### Advantages:

- **Reliability:** Offers reliable performance for high-frequency transmissions.
- **Size:** Their small size makes them suitable for portable equipment and devices where space is at a premium.

### Considerations:

- While SMA connectors offer excellent performance, they are not as robust as larger connectors like the PL-259, and care must be taken during connection and disconnection to avoid damaging the relatively delicate pins.

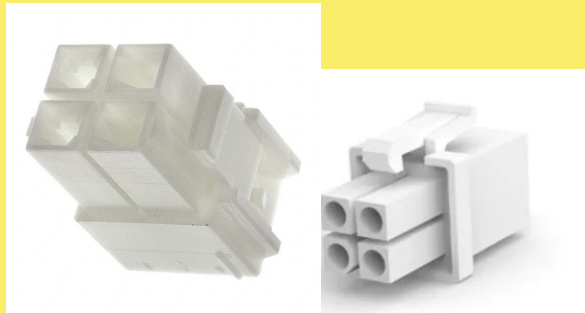


# Powering Up: The Role of Power Connectors



There are many different power connectors used in amateur radio. Let's talk about some of the common ones that you may see

- **Molex** made by the Molex Connector Company in the late 1950s
- **AMP Mate-n-lok** TE Connectivity introduced the Mate-n-Lok connector in October 1963
- **JST VL** OEM connector similar to Molex or AMP
- **PowerPole** made by Anderson Power Products introduced in the 1950's
- **Binding posts** common on power supply will accept a banana plug, spade/fork terminal or bare wire
- **Ring terminals** end of wire crimps can be a ring or spade/fork



# Powering Up: Anderson Powerpoles

Anderson Powerpole connectors are a popular type of electrical connector in various applications, including amateur radio. They are known for their simplicity, reliability, and versatility.

**Uniformity and Standardization:** Anderson Powerpoles have become a standardized connector in the amateur radio community, particularly for 12-volt DC power connections. This standardization allows for easier and more reliable interconnections between different devices and setups, as radio enthusiasts can connect equipment from different manufacturers without compatibility issues.

**Genderless Design:** One of the distinctive features of Anderson Powerpoles is their genderless design. Each connector can mate seamlessly with another, eliminating the need for separate male and female connectors. This feature simplifies setup and reduces the complexity of managing multiple types of connectors.



# Powering Up: Anderson Powerpoles

**Ease of Use:** These connectors are designed to snap together with a dovetail join, which makes them easy to assemble and modify in various configurations as needed. They can be quickly disconnected and reconnected, which is ideal for mobile setups or emergency communications setups that need to be deployed rapidly.

**Durability and Reliability:** Anderson Powerpoles are built to be durable and to maintain a strong connection over time. They are resistant to vibrations and movement, which makes them particularly suitable for mobile operations in vehicles or temporary setups in the field.

**Safety Features:** The connectors are color-coded (typically red and black for positive and negative respectively) and can be configured to prevent reverse polarity connections. This helps in maintaining safety standards, preventing damage to equipment due to incorrect wiring.

**Versatility:** Although commonly used for 12-volt applications, Anderson Powerpoles can handle varying current levels (from 15 to 45 amps typically), making them versatile for different power needs in amateur radio operations.



# Powering Up: The Role of Anderson Powerpoles

Crimping Demonstration







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# Reference Sources

## **Anderson Powerpole - Wikipedia**

Overview and detailed information about Anderson Powerpole connectors.

Link: [Anderson Powerpole on Wikipedia](#)

## **Introduction to Anderson Powerpole Connectors - YouTube**

A video guide demonstrating the use and advantages of Anderson Powerpole connectors in amateur radio.

Link: [Watch on YouTube](#)

## **Ham Radio Coaxial Cable: Everything You Need to Know - W4YAF**

Detailed article covering various aspects of coaxial cables used in amateur radio, including types, characteristics, and selection criteria.

Link: [Read the Article](#)