

# Clarifying Connector Types

Over the years, a lot of different connection methods and connector types have been developed throughout the electrical and electronics industry. When it comes automotive test instruments and leads though, there are mainly two common types: **banana plug** and **BNC**. Even with just two main connector categories, confusion can arise when selecting test leads or accessories. Hopefully this article will help alleviate some of that confusion.

## Banana Plugs

Banana plugs are very common. They get their name from the banana-like shape of the plug (See figure 1). Most everyone is familiar with banana plugs since they've been used for years on multimeters and other popular instruments such as the Snap-on Vantage®. Banana plug test leads usually consist of individual leads for the signal and ground channel or coaxial leads



Figure 1

that split into separate connectors for the signal and ground.

Banana plugs consist of two main parts: the male **plug** and the female **socket**. In general, the plug is found on the test leads and the socket is found on the test instrument, test probes, etc. (See figure 2).



Figure 2



Figure 3

Some test lead extensions may consist of plugs and sockets to allow leads to be connected in series. AES test leads and some others feature a **stacking banana plug** on their instrument end. (See figure 3). These special plugs feature both a male plug and a female socket, allowing you to piggyback the ground lead on multi-channel instruments with only one ground/com input.



Figure 4

The vast majority of banana plugs and sockets use a standard 4mm diameter but there are some variations out there. You'll also notice two other variations of banana plugs: sheathed and unshielded. (See figure 4) Sheathed banana plugs have an insulating sheath around the plug; this is mandatory for high voltage industrial applications. These types of plugs can only be inserted into sockets designed to accept them. Unshielded banana plugs on the other hand, have the



Figure 5

metal plug fully exposed.

While you wouldn't want to use this in a high voltage application, it's perfectly acceptable for most automotive testing. In most cases, unsheathed banana plugs can be inserted into sockets designed for sheathed plugs but the opposite usually isn't true. There are some banana plugs that have the best of both worlds; their insulating sheath is retractable so it can be used in any type of socket. (See figure 5)

When it comes to banana plugs, they are no different than anything else: quality matters. If you've ever used a bargain basement banana plug or test lead, you've probably learned the hard way about their lack of durability and reliability. When selecting test leads or other products using banana plugs and sockets; it's worth the extra money for a quality piece.

### BNC Connectors

The other common type of connector used on automotive test instruments is the BNC. In fact, this common connector is used on everything from industrial lab scopes to audio and video equipment. BNC's are often lumped into the category of RF connectors, which include everything from RCA jacks to "F" connectors on cable and satellite TV systems. BNC is an acronym for British Naval Connector (or so I'm told). It may have had possible beginnings on equipment in the Royal Navy but it's now one of the most popular connectors in the electrical and electronics industry.



Figure 6

BNC connectors also consist of a male and a female half. (See figure 6). This gets a little tricky though since the male and female designation is determined by the small pin or socket in the middle of the connector, not the main portion of the connector body. If you're not sure about how to identify male and female portions of an assembly, maybe you shouldn't have slept through high school health class or perhaps you should get out a little more. The female portion

of the BNC is almost exclusively found on the test instrument while the male portion is normally on the test lead. Some extensions or adapters may feature both male and/or female connectors depending on what they are designed to do.

BNC test leads are usually coaxial type and they normally feature banana plugs on their test end. You'll find BNC connectors on industrial scopes, Fluke scopes, Interro scopes and others.

Most BNC connectors are made of metal and this metal is normally exposed. Sometimes however they may feature plastic insulating material or either the male or female portion of the assembly will be constructed entirely of plastic.

Unlike banana plugs that just push into place, BNC connectors must be pushed and turned to engage their locking tabs. This makes for a secure connection with very little chance of coming loose.

As with anything else, quality matters when it comes to BNC connectors. Low-quality BNC connectors might not meet the correct tolerances and may not always make a good electrical connection. Low quality connectors can also break easily and don't last as long as better pieces.

### Shielded Banana Plugs

I know I said there were only two common connectors used on automotive instruments but since there are an increasing number of Fluke 123 owners, it's a good idea to mention **shielded banana plugs**. These connectors consist of a 4mm banana plug that is surrounded by a larger ring. (See figure 7) Attached to coaxial leads, these plugs are sort of a hybrid between banana plugs and BNC. They provide both signal and shield/ground in one connection. As of this writing, the Fluke 123 is the only instrument using these connectors. Since there are not a lot of accessories out there for this type of connector, it may be wise to purchase an adapter that allows you to attach BNC accessories to your Fluke 123.



Figure 7

### What to do if Your Connectors Don't Match

Very often you may find yourself in a situation where you want to connect a BNC lead or accessory to a banana plug instrument or a banana plug lead or accessory to a BNC instrument. Adapters make this easy. There are adapters with female BNC and male banana plugs or with male BNC with banana sockets. (See



Figure 8

figure 8) This means that just about any lead or accessory can be used with almost any instrument.

### Fixed Pin Tips

So far I've talked about most leads having banana plugs on the test ends. This allows you to connect a wide assortment of probe types such as back-probes, piercing probes, alligator clips and so on. Many instruments though come new with leads that have a pin-tip probe permanently attached. (See figure 9) Most pin-tip probes are .080" in diameter and some have a threaded shank. While you can put some alligator clips



Figure 9

on these probes, their usefulness is limited. We strongly recommend upgrading to banana plug leads to take advantage of the wide assortment of available probes and accessories.

## **Summary**

At first all of the connector options can muddy the waters when it comes to selecting test leads or other accessories. With a good foundation in the basics though it doesn't have to be all that complicated. No matter what instrument you have, there is a lead available to help get the most from it.

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