

Connecting to the Oscilloscope and Waveform Generator: BNC Adaptors and Cables

Peter D. Hiscocks, James Gaston
Syscomp Electronic Design Limited
phiscock@ee.ryerson.ca
www.syscompdesign.com
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Introduction

The connectors on the WGM-101 waveform generator and DSO-101 oscilloscope are type *BNC*.

Figure 1 shows a typical setup of the DSO-101 oscilloscope connected to the WGM-101 waveform generator with a BNC cable. The BNC connector on the instrument is a *receptacle*, the connector on the cable is a *plug*¹.



Figure 1: Instrument Setup

The BNC connector is a *bayonet* or *push-on-and-twist* type connector and very common on electronic test equipment. It is reliable, performs well at high frequencies and is easy to use. Unlike some screw-on connectors, it can be attached and detached very quickly. According to Amphenol, the 50Ω impedance BNC connector is useful to a frequency of 11GHz.

According to Wikipedia,

¹The receptacle is also known as the *female* version and the plug the *male* version. While this anthropomorphic designation of the connectors is appropriate for some types of connectors, it's not immediately evident in the case of the BNC plug and receptacle, which is which.

The connector was named after its bayonet mount locking mechanism and its two inventors, Paul Neill of Bell Labs (inventor of the N connector) and Amphenol engineer Carl Concelman (inventor of the C connector).

In this note, we'll show some methods of connecting to BNC connectors.

Adaptors



Figure 2: BNC Adaptors

An *adaptor* converts a connector from one form to another. Connectors are *reversible*, so an adaptor can be used to convert A into B or B into A. Some useful BNC adaptors are shown in figure 2.

From left to right these are:

BNC plug to Binding Post (2 versions) These adaptors are very useful since they can accept banana plugs and/or bare wire ends.

BNC Tee This adaptor adapts two BNC plugs to one BNC jack.

BNC plug to RCA jack Consumer audio equipment uses the RCA phono connector, so this adaptor allows one to use a standard an RCA to RCA audio cable between the test instrument and the unit under test.

BNC jack to RCA plug This adaptor can be used to convert a BNC plug (usually at the end of a coaxial cable) into an RCA plug. Again, this is useful when testing consumer audio gear.

BNC jack to BNC jack This device is useful in joining two BNC cables together.

Pre-assembled BNC Cables

Various types of BNC cables are available:

BNC to BNC This type of cable is widely available in various lengths. It makes a neat connection between instruments and maintains a complete coaxial, shielded, impedance-controlled connection between source and destination.

BNC to Banana Plug Banana jacks and five-way binding posts are widely used on custom-built equipment as a point of attachment of test signals. This cable can be connected to, say, a generator at the BNC end with the banana plugs inserted into the banana jacks or binding posts. As well, it is possible to obtain alligator clips that slide onto the banana plugs. The alligator clips can then attach to bare metal.

BNC to Mini-Grabber The ever-decreasing dimensions of electronic devices require miniature grabbers at the component end of the cable. Such cables are available ready-made or you can construct them yourself as described below.

Do It Yourself BNC Cable Assembly



Figure 3: BNC Connectors and Cables

Many BNC connectors require a special, expensive² crimp tool for assembly. However, there are some BNC connectors that require no special tools beyond a razor knife and soldering iron. An assortment of these connectors is shown in figure 3. From left to right:

B&L BNC105962 This connector twists on to RG-58/U coaxial cable. The cable end must be prepared by stripping back the insulation and exposing the centre conductor. Then the connector is simply twisted onto the cable using a small wrench.

This connector is arrangement is quite suitable for coaxial cable that is used, say, to connect between a radio receiver and an antenna. However, as figure 3 indicates, it's a fairly thick cable (0.195 inches, 5mm dia) and this makes it inconvenient to handle as a test lead.

The B&L BNC105962 connector and similar parts are available in the Toronto area from Electrosonic Supply.

²We're not kidding about expensive, one of these was \$800USD, though there are some less expensive tools.

74868UG-959U This connector is obsolete, mounts on RG-59 cable and is similar to the third connector.

Amphenol 69475 This connector mounts on RG-174U coaxial cable, which is significantly thinner (0.1 inches, 2.54mm dia) than the other two cables. As a result, it's much more flexible and easier to handle.

Assembly instructions for the type 69475 connector are available on the Amphenol web site, referenced in the *Resources* section of this paper. The 69475 is available from Digikey for about \$13.

RG-174U coaxial cable is available from Belden Wire and Cable as part number 8216 for a 100 foot reel. Belden products are available in the Toronto area through Electrosonic Supply.

Resources

Wikipedia BNC reference:

http://en.wikipedia.org/wiki/BNC_connector

B&L Connectors:

<http://atxnetworks.com/bnl/about.html>

Assembly instructions for RG-174 connector

<http://www.amphenolrf.com/products/assemblyInstructions/299.pdf>

Suppliers

This is somewhat parochial list of suppliers – from the viewpoint of Toronto, Canada.

Jameco Electronics has an excellent stock of adaptors and cable assemblies at very reasonable prices, including a hard-to-find low-priced BNC-Binding Post Adaptor (figure 2). Request their printed catalogue for the details. They are located in California so be careful about shipping charges and avoid UPS shipping: UPS charges exorbitant border brokerage fees. The Jameco URL is insanely long, you can find them with Google.

Mode Electronics stock a wide variety of adaptors and cable assemblies at very reasonable prices. Mode parts are available through Electrosonic and Active-Tech Electronics.

<http://www.mode-elec.com/>

Pomona Electronics manufactures a wide variety of BNC adaptors, grabbers and cable assemblies. They also make adaptors for many IC packages. Very high quality and price to match. It's worthwhile to get their print catalogue. Pomona parts are available through many distributors.

<http://www.pomonaelectronics.com/index.php>

The Source by Circuit City This is the outfit that used to be Radio Shack Canada. They have now become a separate chain. Their web page is fairly hopeless for finding parts but if you have a part number they do have some BNC adaptors. The prices of their audio cables are breathtaking. Get a printed catalogue and check for adaptors.

<http://www.thesourcecc.com/estore/default.aspx?language=en-CA>

Electrosonic Supply Their web page has some limitations. Check stock by phoning them.

<http://www.e-sonic.com/acc/home.aspx>

Active-Tech Electronics Another marginal web page. Go to the web page, find the nearest location, and phone them to check stock.

<http://www.active-tech.ca/b2c/redirect.cfm?pn=2>