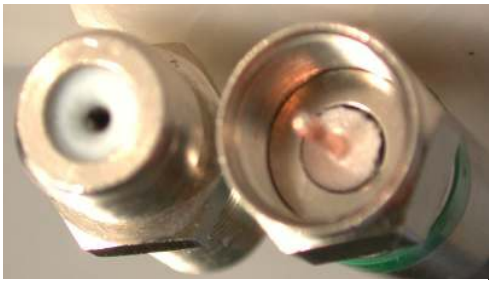
Lightning Protection of 75Ω Impedance Lines

The impedance of a coaxial cable is determined by the ratio of the inner conductor diameter to the inside diameter of the outer shield conductor, and the dielectric constant of the insulation between these two conductors. Applications that require 75Ω cables include most video and audio feeds and some RF transceiver applications. Some popular 75Ω cables include RG-59, RG-6 and RG-11.

F Connectors

When 75Ω cables are used, the connectors should normally be of similar impedance. In the vast majority of 75Ω applications the F connector is used.

A mating pair of F connectors is shown. You may notice here and in many applications, the center conductor is used as the connector "pin" for the male connector. This is particularly true for RG-6 and RG-59 cable. The center conductor in these cables is usually made of copper clad steel (CCS). The steel provides



F Connectors
Female 75Ω and Male 75Ω

stiffness and strength, while the copper cladding provides limited corrosion resistance and better conductivity.

TNC & BNC Connectors

Other popular connectors available in 75Ω are the TNC and BNC. These connectors share the same internal construction, with the difference only being the outer coupling mechanism. The TNC uses threaded engagement, while the BNC uses a ¼ turn bayonet engagement. Some of the internal insulation is removed from the 50Ω versions to make a 75Ω connector.

TNC Connectors
Male & Female 50Ω & 75Ω

Shown here are two mating pairs of TNC connectors. The left pair is a 50Ω version, while the right pair is 75Ω. Notice that the sleeves of insulation surrounding the center gold pins are missing on the right hand 75Ω configurations. Notice also that the center pins and the outer conductors are the same configuration for both male gender connectors (the upper two) and female gender lower connectors. This means that the 50Ω and 75Ω units within a series (TNC or BNC) are fully mechanically inter-mateable. The BNC shares the same internal features mentioned about the TNC.

N CONNECTORS

Another connector for 75Ω applications is the N connector.

N Connectors
Female & Male 50Ω & 75Ω

These are shown with the 50Ω connectors on the left side and the 75Ω connectors on the right side. You may notice that there seems to be no difference in the insulators. However, notice that the right hand side 75Ω versions have much smaller diameter center pins. This change of pin diameter changes the impedance from 50Ω to 75Ω. While these connectors are larger than the TNC or BNC type, the center pin of the 75Ω N is nearly the same diameter as the center pin in the TNC/BNC. When considering intermating the 75Ω and 50Ω N connectors, in addition to an impedance mismatch, there is one caution; the

PTC TNFTNF 23 S

center pins are not compatible. If the 50Ω female is mated with a smaller diameter 75Ω male, then an intermittent contact is likely. If a 75Ω female is mated with a 50Ω male, the larger male pin spreads the spring finger contacts of the female socket, often to the point of bending or breaking off one or more fingers. Also, the power limitation of a connector is usually the center pin. Thus, the RF power capability for the N(75Ω) is approximately the same as the TNC(75Ω) since the center pins are about the same diameter.

RF PERFORMANCE

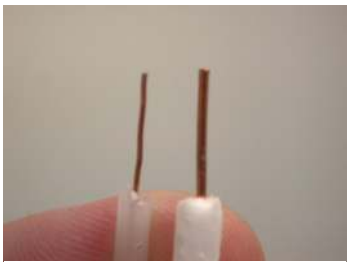
NexTek provides 75Ω F connector protectors which work up to 2.5 GHz. These protectors have been optimized for connection to RG-6 cables. Connectors which use the center conductor of RG-6 are preferred.

PTC-F01

Shown here is a PTC-F01 with female F to female F interfaces. These protectors can be mounted or grounded to a bulkhead panel, a bracket or with a wire lug under the nut shown. The PTC-F01 is available to applications to 1 GHz. The PTC-F02 is available for applications to 2.5 GHz.

NexTek can provide 50Ω protectors available in BNC or TNC, and are intermatable with 75Ω cable connectors. These protectors provide RF performance to 400 MHz or even beyond. This frequency covers the vast majority of video, TV, and other 75Ω applications. Refer to the VSWR and insertion loss plot to show typical performance. If you have higher frequency needs or have exceptionally stringent RF specifications, then the use of a true 75Ω solution may be necessary. It is often best to consider the PTC-F02 for these demanding applications.

SURGE PROTECTION



RG-59/U and RG-6

The surge capability for any connector and cable system interface is limited by the cable, the connector contacts, and the surge protection component. The smaller format cables, RG-59 or RG-59/U, have a small 0.0224"(.57mm) or .034 (0.86mm) diameter center conductor. These center conductors have limited capability for transient current and NexTek recommends that these smaller cables not be used for outdoor or exposed cable runs.

While protectors can easily protect against a transient, there will be a tendency to melt or burn out the center conductor, requiring a service call and resulting in a outage after all. NexTek has optimized the PTC F line to accept the full transient capability of an RG-6 center conductor. This center conductor is a larger 0.041" (1.05mm) diameter. The RG-6 cable has reasonable transient capacity, since the center conductor is about twice the diameter of RG-59, and thus has about 4 times the cross section area. For serious surge risk applications use at least an RG-6 cable. A solid copper conductor RG-59 type is even better, such as Belden 1694A, 1829A, or equivalent. While RG-11 can be terminated in N(75Ω) or even TNC(75Ω) connectors, their use is typically in 5/8-24 threaded interfaces. Usually this cable has to be terminated in a connector with a center pin. The use of F, TNC(75Ω) or BNC(75Ω) may be the best solutions, since the N connector really doesn't provide much higher capability, and there is risk of inadvertent N75Ω to N50Ω intermating damage.

NexTek always uses high transient pulse protectors components, capable of multiple strikes and severe duty. All of the protectors mentioned here use a 8mm diameter x 6mm high gas discharge tube, that provide long service life with minimal maintenance.

75Ω TEST DATA

50Ω PTC BNC or TNC Protectors tested in a 75Ω Circuit; showing excellent RF performance to over 400 MHz.