

design Making Connections with Twinax and Triax Cable Assemblies

FAQs

FREQUENTLY ASKED QUESTIONS

Q. How is a Twinax cable constructed and how is it different than a coaxial cable assembly?

A. Quite simply, Twinax cables use two inner conductors compared to one in a standard coaxial cable. Twinax cables are constructed with a two-conductor twisted balanced wire line at a specific impedance (such as 78 and 124 Ω), surrounded by an outer braided shield with dielectric isolation between the braided shield and the conductors. Twinax cables are protected by a halogen-free, flame-retardant polyolefin outer jacket rated for operating temperatures from -30 to +80°C.

Q. Why use a Twinax cable rather than a coaxial cable? How does the performance differ?

A. Twinax cable, with its two center conductors, provides greater flexibility and less fatigue with bending than coaxial cables, especially for applications requiring short cable runs. Such flexibility translates to much higher reliability for applications with excessive cable movement, along with less degradation in electrical performance from cable bending over time. The use of two copper wires in a braided weave helps to minimize signal loss and the effects of ground loops and protect against low-frequency noise from magnetic (H) fields.

Q. What is a Triax cable and how does it differ from coaxial or Twinax cables?

A. Triax cables incorporate a single center conductor like coaxial cables, although it is comprised of braided wire rather than a solid conductor. They surround it with PTFE dielectric which in turn is surrounded by a braided outer conductor to produce cables with nominal impedance of 50 and 75 Ω . Where Triax cables differ from both coaxial and Twinax cables is in adding a second dielectric layer around the outer conductor AND a second braided outer conduc-

tor. As with Twinax cables, Triax cables are protected by a halogen-free, flame-retardant polyolefin outer jacket rated for operating temperatures from -30 to +80°C.

Q. What are the performance advantages of a Triax cable?

A. For its durable construction, Triax cables still provide a minimum bend radius that is comparable to that of coaxial and Twinax cables, at 1.25 in./ft. of cable, with only slightly higher insertion loss than coaxial or Twinax cables at 50 Ω . However, with its second outer conductor layer, Triax cables excel in handling high voltages, with a maximum voltage rating of about 6 kV compared to at most 2 kV for coaxial or Twinax cables. In addition, the outer braided conductor of Triax cables is well isolated from the inner braided conductor, and can be used as a low-impedance transmission line where needed.

Q. How do Twinax and Triax connectors compare to BNC connectors and when would it make sense to use them rather than a BNC connector?

A. Twinax and Triax connectors are the same size as BNC and TNC connectors. They differ from BNC connectors in the ways that Twinax and Triax cables differ from coaxial cables, with enhanced shielding for improved suppression of noise especially at low signal levels. Twinax connectors, for example, are often referred to as twin BNC connectors since they accommodate dual center conductors with keyway polarization for improved signal integrity (SI) compared to standard BNC connectors.

Q. What are some of the key performance specifications for a Twinax connector and cable assembly?

A. For applications requiring high shielding, as much as 30 dB more than BNC connectors, Twinax connectors combine with

Twinax cables to form assemblies with excellent SI performance. Especially in higher-impedance (78 and 95 Ω) applications with in-phase (I) and quadrature (Q) differential signals that must be transferred at high speeds and with high isolation, Twinax cable assemblies provide low attenuation with excellent suppression of low-frequency noise and relatively high voltage ratings (to about 500 V).

Q. Can the same specifications be used to characterize a Triax connector and cable assembly?

A. Triax connector and cable assemblies with their single center conductor but additional outer braided conductor bring outstanding shielding and SI performance to 50 Ω applications. Triax connector and cable assemblies protect high-sensitivity signals from noise but also provide the extra shielding required to prevent the cable assemblies from radiating electromagnetic (EM) energy where it might affect the performance of nearby components in critical commercial and military systems applications, including for high-speed data transfer.

Q. Are adapters available to mate Twinax and Triax connectors with other connector types?

A. For system or test applications requiring between-connector interfaces, adapters are available to mate Twinax and Triax connectors to most standard coaxial connectors within their operating frequency ranges, including BNC, Type N, TRS, TPS, and TNC coaxial connectors, in various configurations of male and female interconnection combinations.

Q. Can Twinax and Triax connectors and cable assemblies be used in military applications, notably for systems that may require hermetic seals? If so, does the hermetic seal degrade per-

formance in any way?

A. Both Twinax and Triax connectors are available separately and with cables as MIL-STD-1553B data bus components for military and aerospace applications. They are supplied as qualified products list (QPL) approved components per MIL-C-49192 military requirements. Twinax and Triax connectors can be supplied in various formats, including as plugs and jacks, for use as terminations with printed circuit boards (PCBs) and various types of cables in cable assemblies. In addition, both types of connectors are available in hermetic versions, with glass-to-metal seals to prevent leakage through the bulkhead from the inside of the connector. Hermetic connectors are supplied in various formats, including front-mounted, rear-mounted, feedthrough, and subminiature types with low leakage rates (1×10^{-6} atm-cm³/s or better).

Q. Can Twinax and Triax connectors and cable assemblies be used in 75 Ω CATV applications? If so, are other impedances available, and when and why would they be used?

A. Triax cables are available with nominal characteristic impedance of 75 Ω for low-loss applications in 75 Ω cable-television (CATV) systems, especially where noise and interference from outside noise sources must be minimized. In addition, for CATV and high-speed data applications, Twinax cables are available in standard models with nominal impedances of 78 and 124 Ω .

Q. How are Twinax and Triax connectors tested for performance in terms of the basic specifications noted earlier?

A. Both Twinax and Triax connectors are constructed from high-quality materials, including nickel-plated brass bodies and beryllium-copper outer and center conductors, with push-on and threaded versions available. They meet the testing requirements of MIL-C-549192, which include corona voltage testing, 24-hour salt spray, shock, vibration, thermal shock, and hermeticity (where applicable). For particularly demanding applications, they can be manufactured with special plating to meet the 500-hour salt-spray requirements of MIL-STD-1344.

Connectors are also tested for mechanical specifications, including engage and disengage force, cable retention force, and coupling torque. For users interested in evaluating their own cable assemblies, a Twinax/Triax Cable Assembly Tester is available to check for opens, shorts, and cross-wired connectors. ■

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Twinax/Triax Connectors

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