Positronic Industries

white paper

Connector Specs Help with Multi-Sourcing

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Vast numbers of connector choices are available to design engineers, with more becoming available all the time. Connector designs encompass many shapes and sizes that are tailored to a wide variety of applications and performance needs. With so many different types of connectors, it is no surprise that many have limited sources. In cases where multiple sources do exist, it is often difficult to be certain that the connectors are compatible with each other.

Compatibility

To understand the complexity of the compatibility issues between connector manufacturers, it is helpful to define the levels of compatibility. In general, there are three.

1. **Intermountability** *(dimensional elements)* - this first level standardizes only overall dimensions and mounting distances for a particular connector. This does not ensure that connectors can be properly coupled.

2. **Intermateability** *(dimensional and electrical elements)* - in addition to standardizing overall dimensions and mounting distances, this second level incorporates standardization of electrical and mechanical interfaces. This ensures that connectors can be coupled together.

"Full compatibility can be achieved only when **connectors produced by various manufacturers** meet the requirements of interchangeability."

3. **Interchangeability** *(dimensional, electrical and performance elements)* - The third level, the highest level of compatibility, standardizes all performance elements in addition to those elements described in the first two levels. This ensures that the performance of the connector pair is maximized.

When a user is considering a second source, maintaining the highest level of compatibility should be a primary concern. If ignored, problems may occur.

To avoid incompatibility issues, the user must recognize that connectors from multiple sources are not necessarily fully compatible just because they are capable of being coupled together *(i.e., intermateable)*. Full compatibility can be achieved only when connectors

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produced by various manufacturers meet the requirements of interchangeability. The only way to ensure interchangeability is through a detailed specification that establishes dimensional, electrical and performance requirements. Usually, these specifications are developed through the efforts of national or international organizations such as the International Electrotechnical Commission *(IEC)* or governmental agencies such as the Department of Defense.

Specifications

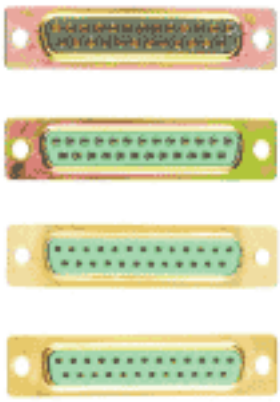
Once a specification is developed around a connector type, the user has a basis on which to evaluate multiple sources. *Figure 1* shows a series of D-subminiature connectors. Each connector meets specification requirements, as shown. All of these connectors are intermateable because of common dimensional and electrical requirements given in each specification. However, they are not interchangeable because they meet different performance requirements, as outlined in their individual specifications.

"Once a **specification is developed around a connector type,** the user has a basis on which to evaluate multiple sources."

Say a connector that is compliant to the IEC-60807-2 specification is substituted for one half of a connector pair that is compliant to MIL-DTL-24308 specifications. After the substitution, the performance levels of the connectors are no longer compatible; the IEC-60807-2 connector is industrial-grade while the MIL-DTL-24308 connector is military-grade. In cases such as this, the performance of the pair is reduced to that of the weaker member. The user may have accomplished a price reduction by purchasing the industrial-grade connector but at the cost of performance in the application.

In addition to specifications written specifically for connectors, connector specifications may also be embedded within the body of a larger, more general document that details requirements for systems or system components. For example, the PICMG 2.11 Power Interface specification outlines requirements for modular power supplies used in CompactPCI systems.

Figure 1



These D-subminiature connectors appear virtually identical and, in fact, are intermateable, but they are not interchangeable because of different performance characteristics.

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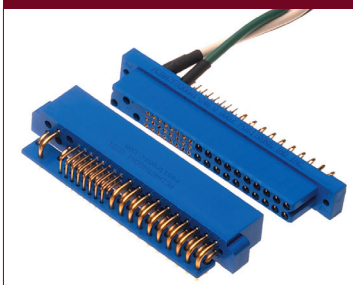
Within the body of this document, there is a connector specification that outlines the requirements of the power interface connector, such as those shown in *Figure 2*.

In addition to consulting pre-existing specifications, users may develop their own connector specifications with corresponding internal documents. Connectors from multiple sources can then be evaluated against these documents. This method is not commonly used, however, because of the great number of resources required to develop, maintain and test to an internal specification.

Figure 2

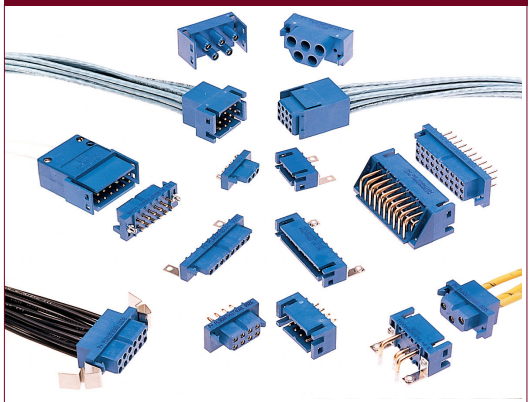


Power connectors compliant to the PICMG 2.11 Power interface specification.

"The only way to ensure **Interchangeability** is through a detailed specification that establishes **dimensional, electrical and performance** requirements."

Finally, some connector types are widely used and become "defacto standards" within certain applications. For instance, *Figure 3* shows a power connector system that has become a defacto standard in the electronics industry. In the absence of an organized specification effort or close cooperation between manufacturers, the user is left to wonder if compatibility truly exists when multiple manufacturers copy popular connectors and market them as such. Without a specification to govern requirements, manufacturers are free to make changes to their designs without considering the effect on compatibility. In some cases, proprietary technology and even patent issues create problems for the user. Specifications serve to minimize these problems.

Figure 3



These connector types have become defacto standards and are being copied by multiple manufacturers and marketed as such.

Conclusion

Multiple sourcing of connectors is of value to manufacturers of electronic equipment. Credible specifications that detail dimensional, electrical and performance requirements allow an informed decision to be made regarding multiple sourcing. By using a specification to make sourcing decisions, the user may avoid failures that can occur because of subtle incompatibilities between connectors from different manufacturers. This ensures the quality of the end products that will be shipped in the future as well as provides for compatibility with products already in use.