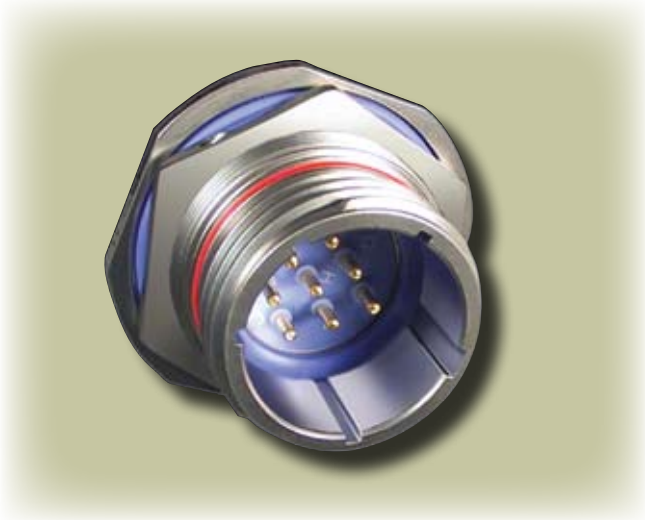
A

EMI/EMP Filter Connector Overview

Filtering or suppression of electromagnetic noise within the connector package is reliably accomplished through the integration of capacitors and diodes into the connector to segregate interfering high-frequency or high voltage noise from the desired lower frequency signals. The capacitors strip off the interfering noise from the signal as it passes through the filter device. While various types of capacitor filters are available, perhaps the most widely applied is the Planar Array type. Planar Arrays are extremely effective at filtering high-frequency interference. Planar Array designs utilize ceramic capacitor arrays and ferrite inductors which externally surround each contact, and may be supplied in a single monolithic block to fit into any connector size or shape. Planar arrays may be fabricated with different capacitive values on individual pins for additional flexibility in achieving the desired level of EMC. Diodes are used to clamp the voltage below a certain value, thereby protecting the electronic circuity. They are typically integrated into the connector using a small printed circuit board.



Ferrite elements and capacitors can be integrated into any connector package envelope.

Using filter technology has certain advantages to the electrical system engineer, most especially improved signal integrity as well as size and weight reduction. In addition, filters can be incorporated into an interconnect system late in the research and development process; for example after an unforeseen emission problem has been detected. In every filter application the signal levels and frequency bands must be well understood in order to select the appropriate mode or type of filter technology.

For example, electronic equipment used by avionic systems typically spans the electromagnetic spectrum from a few kilohertz to several gigahertz. At the low end, Omega Navigation, which is used to fix aircraft position within a network of ground based transmitters, operates in the frequency range of 10 to 14 kHz. VHF Omnidirectional Range Finders (VOR) are radio beacons used in point-to-point navigation. They operate from 108 to 118 MHz. Glideslope Systems used during landings operate in the 328 to 335 MHz range. Distance-Measuring Equipment (DME), which gauges the space between the aircraft and ground-based transponders operate at just over 1 GHz.

Clearly, potential EMI in the application environment described above covers a broad range of frequencies. Filter modes and types are consequently specified according to the EMI frequency ranges which are the source of the actual signal degradation and the operating frequency of the affected device. Certain electrical circuit criteria are also germain to filter selection, including:

- Capacitance Value
- Working Voltage
- Surge Voltage
- Dielectric Withstand Voltage
- Insulation Resistance
- Transient Protection

Introduction to Filter Connectors
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Filter connectors appropriate for use in applications such as those referenced above are broadly identified as 'low-pass' filters (i.e. they let low frequency signals pass through and attenuate higher frequencies). The attenuation curve can be shaped using different filter types (different configurations of capacitors and inductors). These types include: Pi Filter, L-C or C-L Filter, and C Filter. These filter connector types are characterized by their relative abilities to filter noise according to capacitance, voltage values and load impedances. The simplest design is the "C", which consists of a single capacitor inserted between the signal line and ground.

While most EMI filter connectors can be used in a working temperature environment from -55 to 125° C, selected designs are optimized for higher operating temperatures. Hermetic Filter connectors provide the ultimate protection– ensuring system hermeticity while the added filter/diode elements safeguard electrical signals passing through the connector.

Prior to shipping a filtered connector, Glenair offers extensive testing, qualification and burn-in options. Tests range from a simple capacitance (C), insulation resistance (IR), and dielectric withstanding voltage (DWV), to more elaborate options such as RF insertion loss, dissipation factor, Zener/TVS diode test, ground resistance, voltage conditioning and thermal shock.

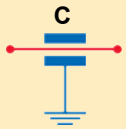
The Glenair factory, provided with the system attenuation and frequency values, relevant electrical specifications, and connector configuration details can design an effective filter device for every application (to get started, use the application checklist on the last page of this introduction). Glenair is able to supply filter technology in every cylindrical connector standard we produce including our Series 80 "Mighty Mouse" as well as MIL-C-38999, Mil-C-5015, MIL-DTL-83513, Mil-C-24308, and so on. Custom circular and rectangular styles are also available. Hybrid electrical/optical filter connectors are a specialty.

COMMON FILTER CONNECTOR TYPES

Glenair supplies filter connectors in the following electrical configurations: C, L-C, C-L, and Pi. The following general values may be used in type selection: Single element filter connectors sporting either a single capacitor or inductor yield an insertion loss characteristic of 20dB per decade, dual element filters (capacitor plus an inductor) 40dB per decade, and triple element filters 60dB per decade. Selection is based primarily on source and load impedances but may also be influenced by the level of attenuation required at various frequencies. Please consult the factory for assistance in evaluating insertion loss values. All insertion loss values quoted for a 50 Ohm impedance.

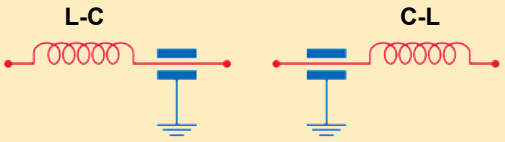
C Circuit Filter

Single capacitor with low self inductance. This configuration is generally used to attenuate high frequency signals. The simple design allows high-frequency EMI to discharge to ground via the surrounding electromagnetic field.



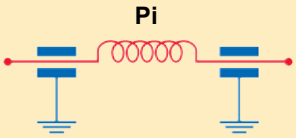
L-C or C-L Circuit Filter

Single capacitor combined with an inductive element. It is commonly used in a circuit with a both a low impedance source and a high impedance load or a low impedance load and a high impedance source. The inductive element should face the low impedance.



Pi Circuit Filter

Dual capacitors with a single inductive element positioned between them. The Pi filter provides exceptional high-frequency performance due to its sharper rolloff and is typically used when both source and load impedances are high.



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