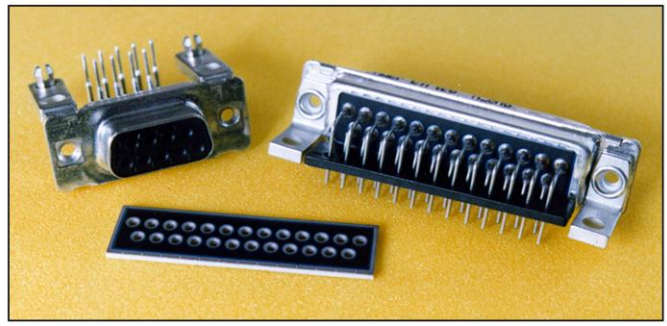
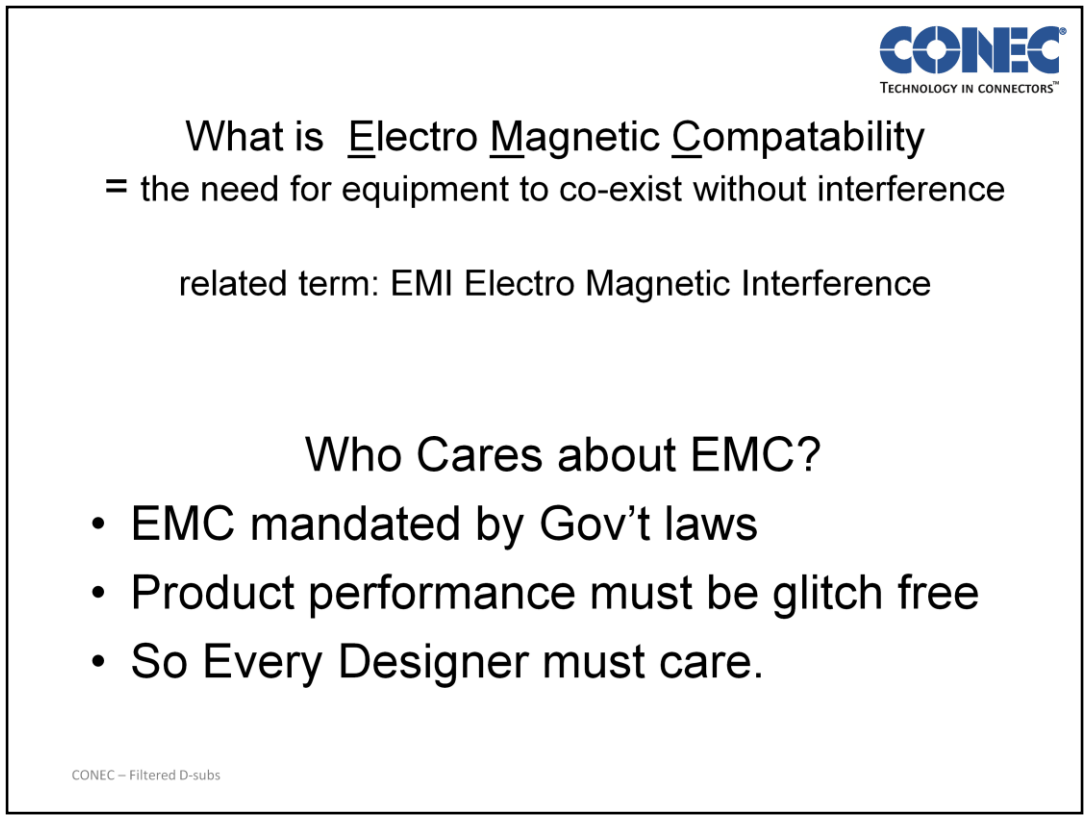
CONEC
TECHNOLOGY IN CONNECTORS™

Connection Technology For EMI Control

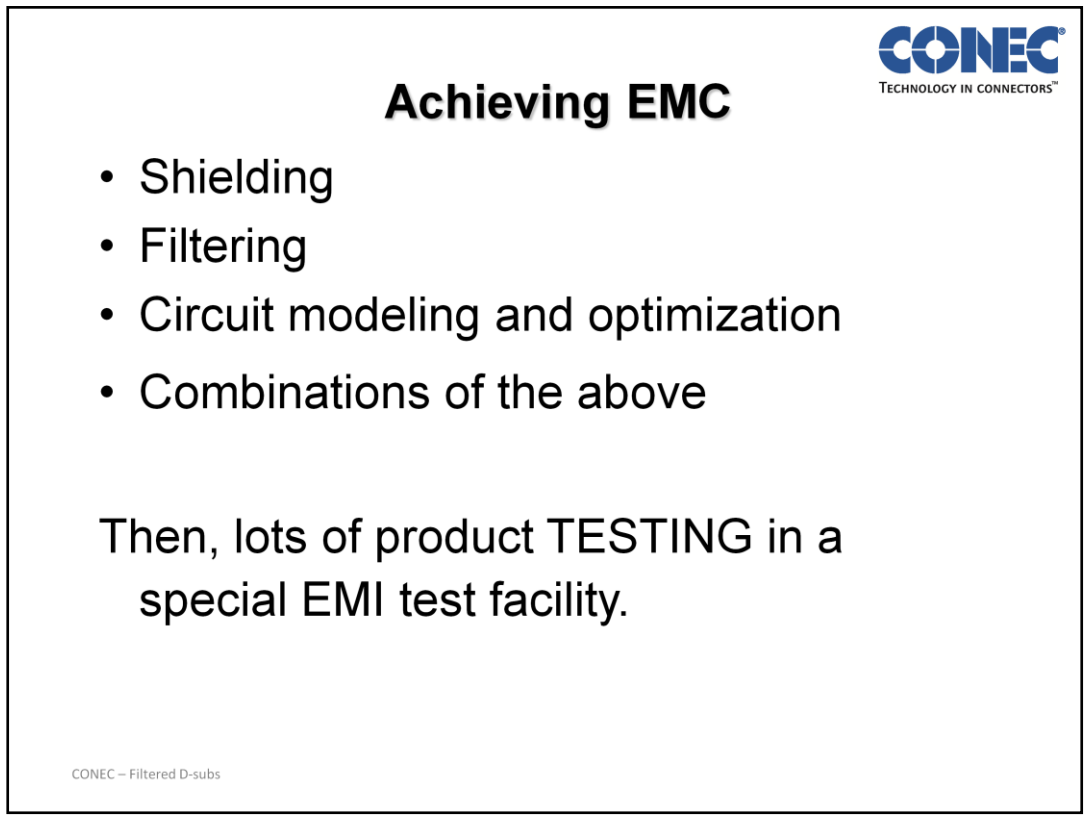


Filtered D-subs

Welcome to Conec EMI Filter Connectors. Conec is a world-class manufacturer offering one of the broadest lines of EMI Filtered D-subs for the commercial markets. Our many years of engineering excellence provide EMI solutions for many industries.



As electronic equipment proliferated, and frequencies increased, it became apparent that equipment could interfere with the performance of adjacent equipment. Thus the rules and regulations of FCC type organizations forced circuit designers to implement means to control EMI.



Shielding means “putting everything in a closed conductive box” to prevent radiation. This works if there are no interconnections >> Interconnections cause EMI leakage by conduction along the wire and into the other device, and by radiation from the protruding wires (if they’re not shielded). Each I/O wire acts like an antenna to radiate or pick up EMI!

Filtering controls EMI only when it is in the conduction mode. That is why filter connectors are so highly successful at controlling EMI: they are at the interface (usually where the shielding is open to leakage), and they control the conducted part. Thus a shielded and filter connector would be ideal.

Usually need a combination of shielding & filtering, neither one alone does the job. Only testing verifies whether it works well enough to meet the spec’s.

FILTERS : What do they do?

- Filters distinguish on the basis of **Frequency**; not voltage not current.
- Desirable electrical signals are separated from the Undesirable signals.
- Filter connectors are LOW PASS
- Filters are used to control both EMI Emissions, and EMI Susceptibility.

Filters should keep the good part of the electrical signal, and get rid of the unwanted part. Typically the unwanted 'noise' is in the High frequency end, and those are the frequencies that we want to get rid of, thus the "real signals" are kept.

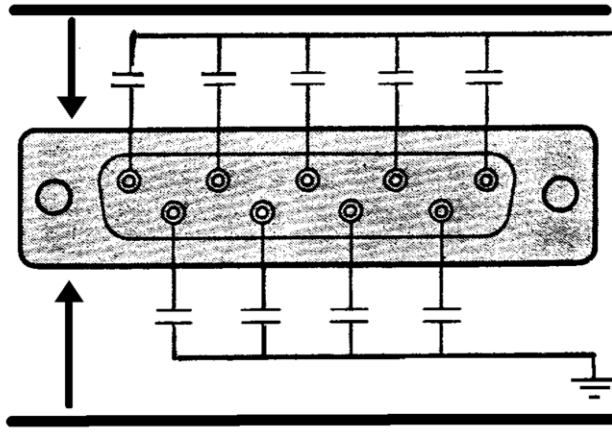
Filters work in both directions, meaning: controlling what goes out, as well as what comes INI to the equipment.

Capacitors, as Filters

- The Best Filter Connectors use Capacitors
- Capacitors are *Frequency* Sensitive
- Capacitors can be created in several ways
- ceramic: chip, tubular, planar

Filter Connectors contain capacitors as the filter component. So while a Filter connector might Look like a normal connector, the ‘magic’ is hidden inside.

Filter Connectors:
A Capacitor Packaging Challenge

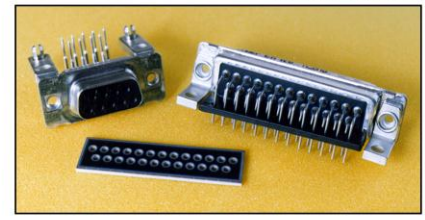


The challenge is to pack all the filter capacitors in the same size housing as a standard connector.

electrical equivalence shown

Simple pictorial to show that a filter connector actually contains many capacitors, One for each contact position. Each is also connected to the grounded housing, and individually connected to the contacts.

CONEC Filtered Connectors



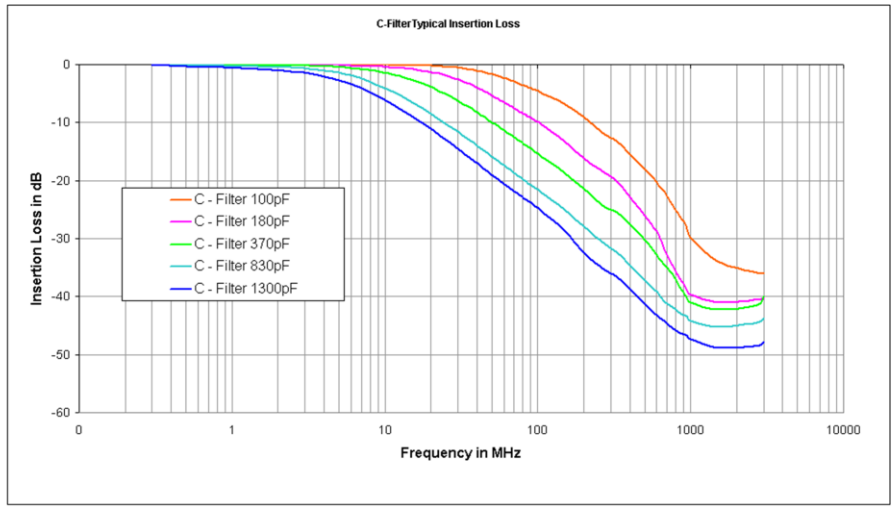
- **Linear filtering thru 1 GHz.+**
- **ALL filter types: L, C, LC, Pi**
- **Patented “Planar” technology**
- **“C” Types are same size as unfiltered**
- **‘Adapters’ provide easy retro-fit, test**

CONEC – Filtered D-subs

Conec offers a very broad product range, utilizing several filtering concepts. Due to Conec’s proprietary planar technology, the most cost effective type, with planars, is therefore also the most widely used by customers.

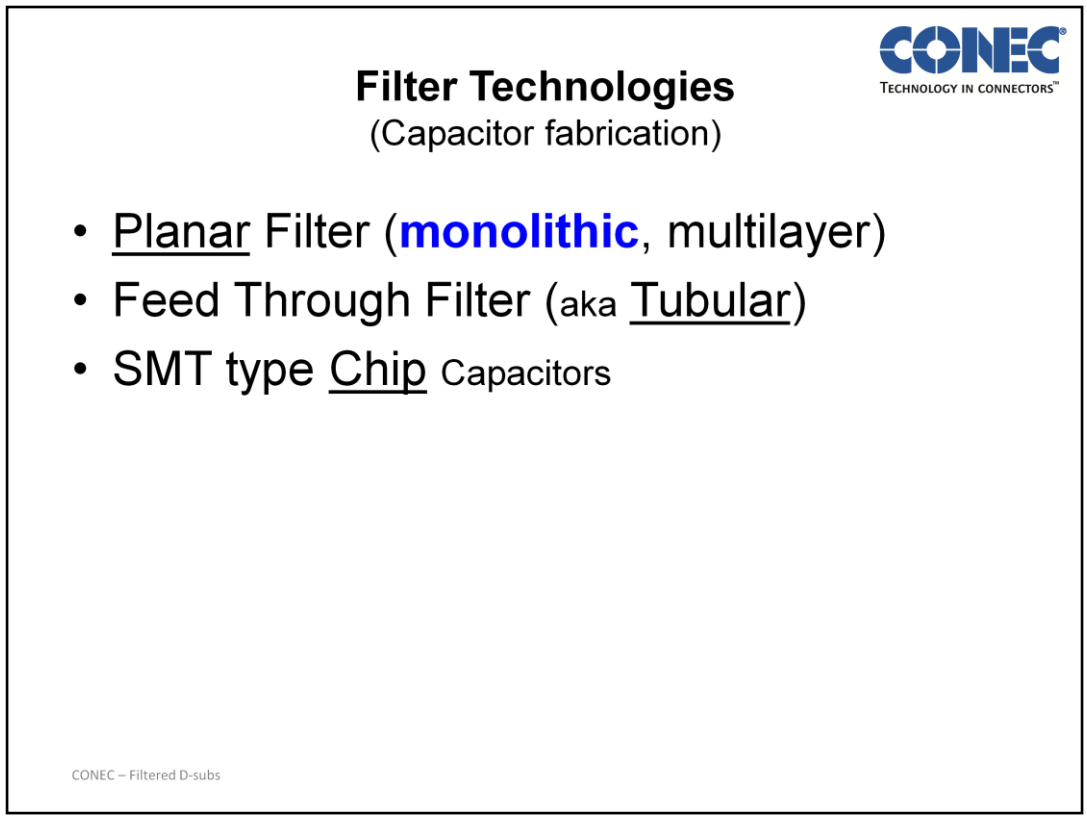
Insertion Loss Graph

Shows Attenuation (dB.) vs. Frequency (MHz.)

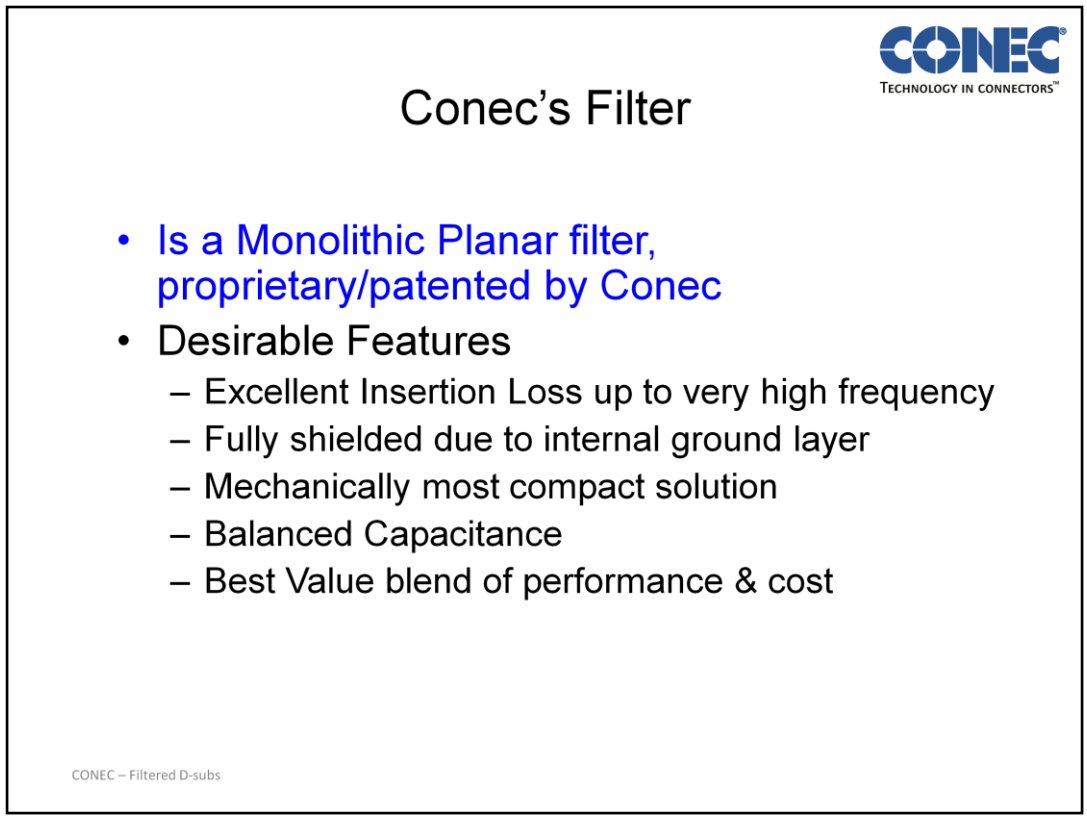


CONEC – Filtered D-subs

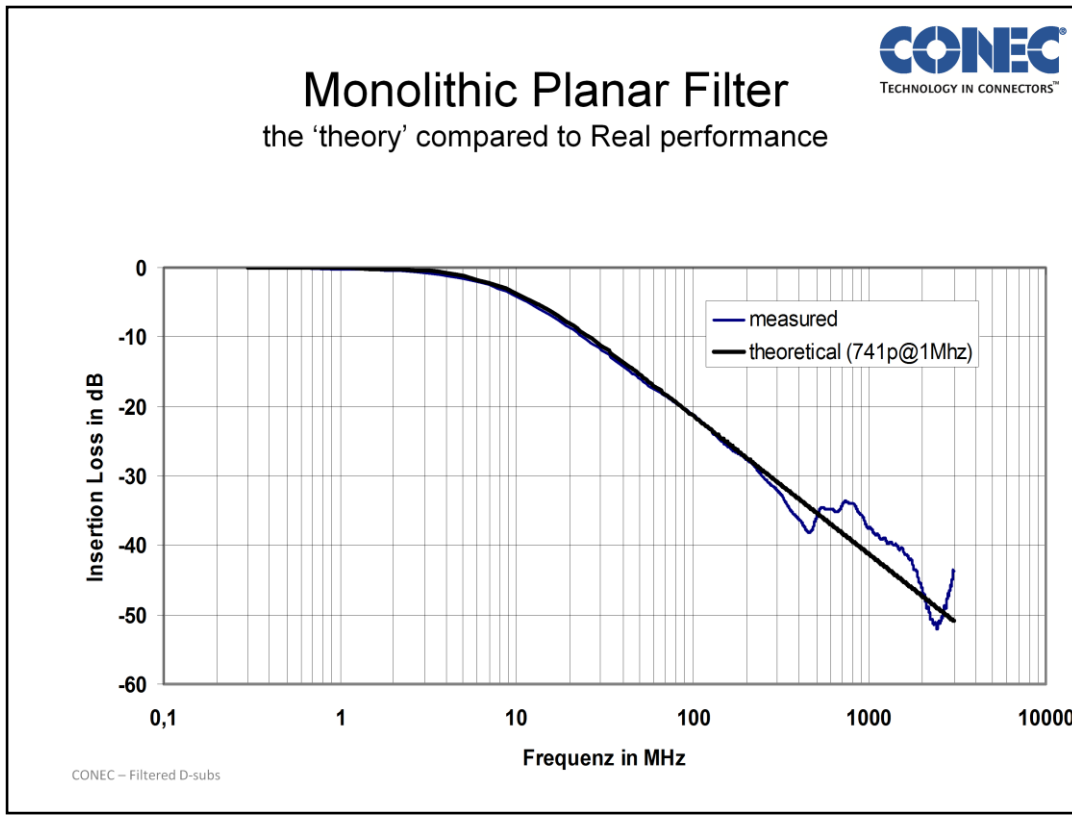
Almost always, 'loss' is not desirable. However, for EMI control, the goal is to create a loss at specified frequencies. Since most Filter connectors are "Low Pass", the idea is to 'not pass' the problematic high frequencies, hence the loss shown in the graph is very good. Differing capacitance values provide a different frequency attenuation. The designer selects the capacitor value based on his needs and such Insertion Loss data.



Special technologies are used to create capacitors that are suitable for embedding inside a connector. While Conec uses them all, depending on the application, most connectors use the 'planar monolithic' construction.

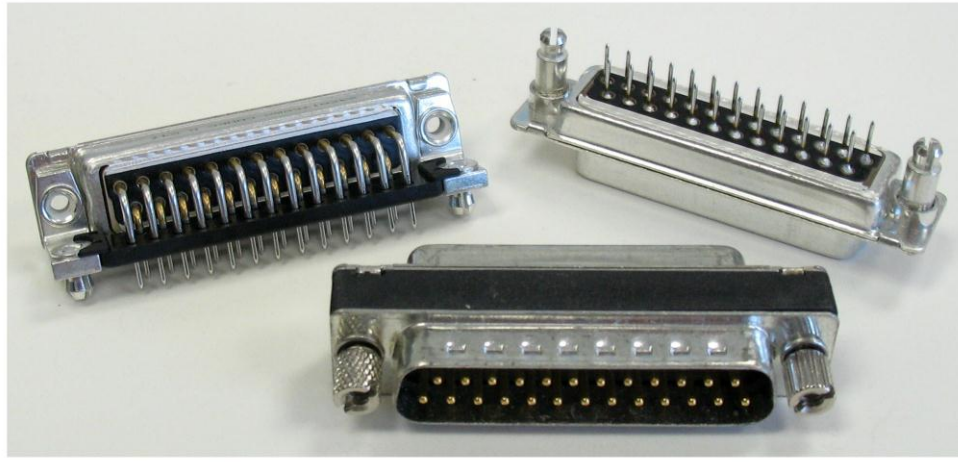


Conec's more than 25 years experience with Filtering D-subs has proven the patented technology used, and offered the marketplace excellent EMI performance, at very competitive prices.



Conec's filter technology has excellent performance, as shown by the very near ideal frequency performance. There are no nasty performance degrading resonances, that may occur in some alternative technologies.

Same Size, same fit!

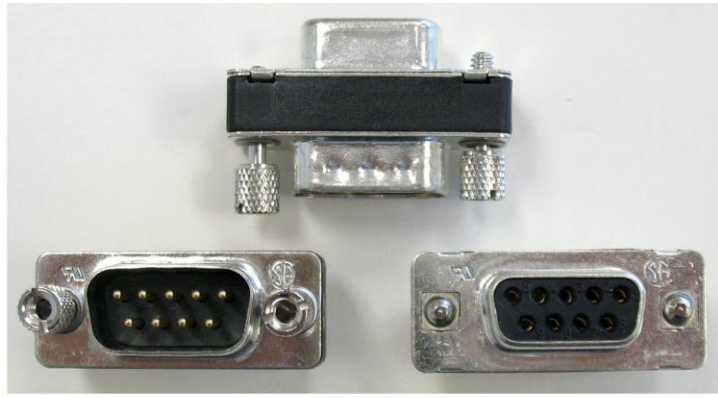


CONEC – Filtered D-subs

Conec's Filtered D-subs, occupy the same space as an Unfiltered D-sub, therefore there is no penalty in space, and easy retrofit in the design is possible.

Filtered Adapters

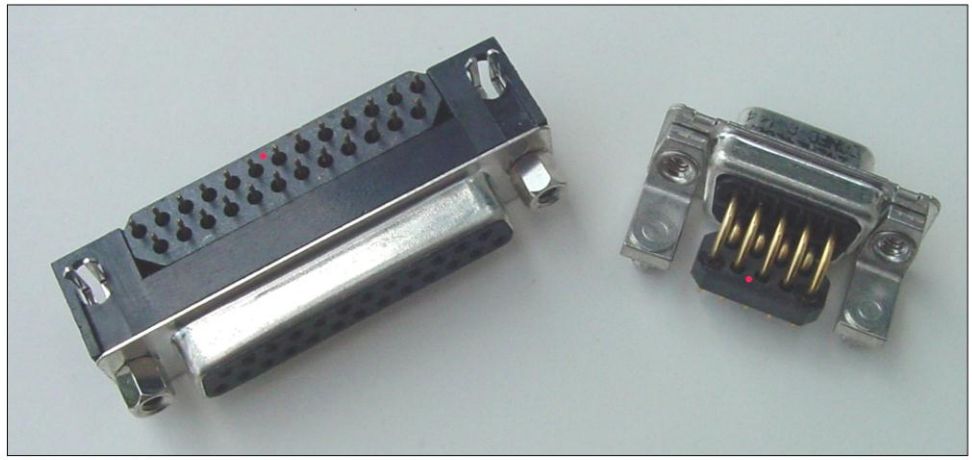
- Simple ‘plug ‘n play’ as they say
- Creates an EMI filtered port w/out Soldering
- Useful for testing as well as retro-fit



CONEC – Filtered D-subs

These male-one-end, female-the-other ADAPTERS, simply plug into an existing D-sub. With no soldering, the port now EMI protected. This is also a useful diagnostic ‘tool’, since it can easily be moved or exchanged to optimize the value of capacitance needed. Use of ADAPTERS allows easy EMC upgrades to existing systems.

Ferrite Filtered D's



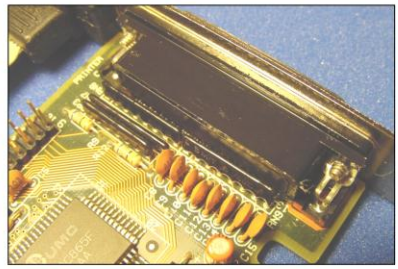
CONEC – Filtered D-subs

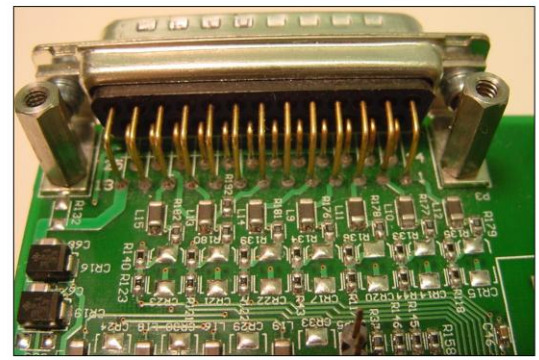
Some filter connectors use Ferrite slabs (shown with red dot), instead of capacitors. While being low cost, they are also very low performance. Be careful not to compare Capacitive Filter connectors, with Ferrite filters.

CONEC
TECHNOLOGY IN CONNECTORS™

Is there an alternative to Filter D's?

- On-Board filtering





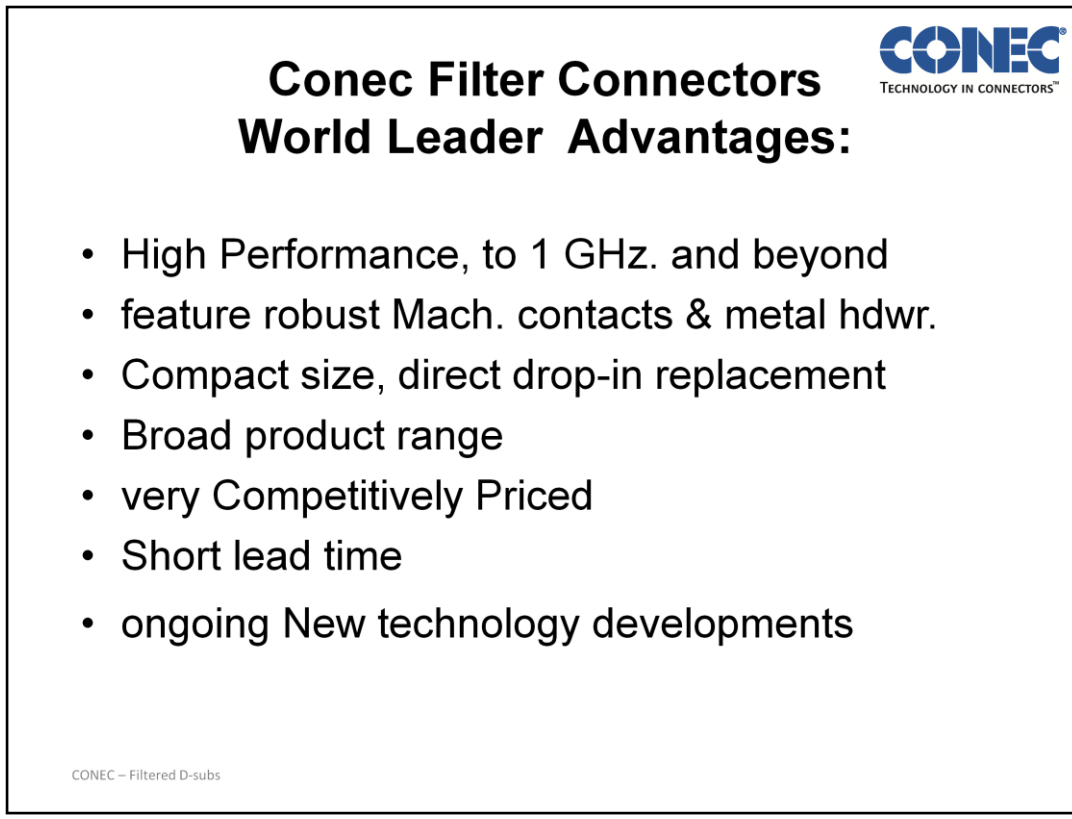
CONEC – Filtered D-subs

Many designers attempt to control the EMI performance of their I/O ports using 'on board' components. Pictured are the many capacitors, inductor chips and resistors that you see behind the connectors. Varying degrees of success are possible, but often the resulting EMI performance is not as good as putting the filters IN the connector itself.

Performance Comparison

- L ferrite only, 5-7 dB.
- C capacitor, on board 15-20 dB.
- **C capacitor IN Filter Connector 40+ dB.**
- LC cap. filter connector plus ferrite 50+ dB.
- Pi filter connector cap/ferrite/cap 80+ dB.

Comparing the various types of Filter configurations, you see the ‘sweet spot’ is the Capacitive Filter Connector. That’s because it offers substantial EMI control, at very competitive prices.

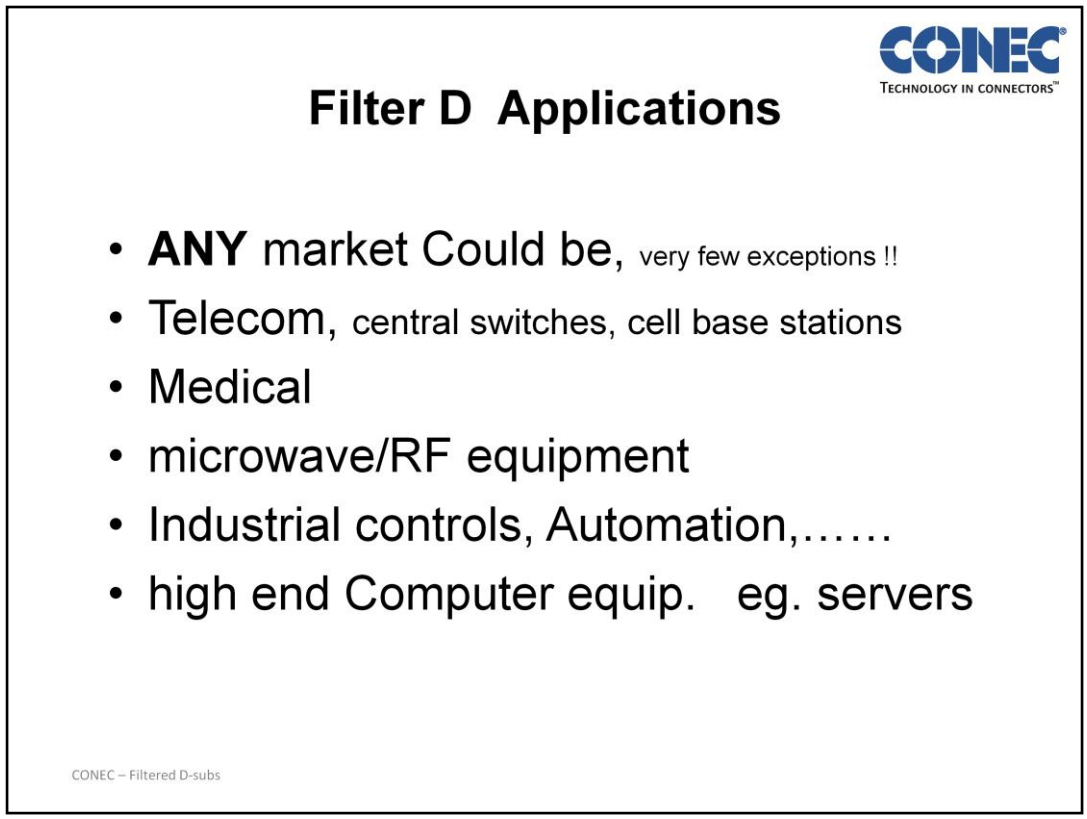


Conec's Filter connectors are a preferred EMI solution, because they combine excellent EMI performance, in a high end commercial connector, in a very broad range of configurations.

EMI Accessories

- EMI hoods
- Grounding Hardware
- EMI Gaskets
- Screen Caps

EMC is a total system design, therefore in addition to the Filter connector, shielded accessories are often specified to ensure total performance.



Since the regulations and market needs for electromagnetic compatability apply to ALL electronics, clearly any device that uses a D-sub as an I/O port, should consider the benefits of a Filtered D-sub in their EMI design process.