ElectronicDesign

Simplify Your Designs with Modular Connectors

Presenters:
Joydip Sanyal, Product Group Mgr., General Industrial and Aerospace and Defense - Connectors BU, Smiths Interconnect, a Molex company
Jerilynn Johnston, Distribution Manager, Americas, Smiths Interconnect, a Molex company

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KEY TAKEAWAYS

- Key market trends drive modular connector adoption.
- Smiths Interconnect's L Series modular connectors simplify design challenges.
- The L Series enables applications across industries.
- The L Series uses modularity to "future-proof" system design.
- Smiths Interconnect's strong industry partnership with TTI ensures supply chain reliability.

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Simplify Your Designs with Modular Connectors

OVERVIEW

Designers of high-reliability systems need to use rugged connectors, such as those that employ hyperboloid architecture. Hyperboloid-based connectors have a low insertion force and superior current-carrying capacity, and handle applications with high levels of shock and vibration. Easily customizable building block modules and hyperboloid contact technology enable more reliable, vibration resistant, and long life connectivity for demanding electronic systems.

Smiths Interconnect, a Molex company, is a leading supplier of application-specific, high-reliability electrical interconnect solutions from highly integrated assemblies to micro-miniature connectors and spring probe contacts. Smiths Interconnect's next generation L Series modular connectors are designed for rugged environments, high density layouts, and ultimate design flexibility, providing a versatile, robust solution for a wide array of industries.

CONTEXT

Joydip Sanyal discussed market factors driving demand for modular connectors and explained how Smiths Interconnect's L Series connectors enable long-lasting, highly reliable electronic system design.

KEY TAKEAWAYS

Key market trends drive modular connector adoption.

As electronic systems grow more complex to meet the requirements of high-performance, data-intensive applications, there is increased demand for more modular connectors. Key market trends include:

- **Integration of power, signal, and data.** The market has seen a significant increase in demand for high-reliability modular connectors that combine power, signal, and data modules—including Ethernet, fiber optics, and even pneumatic modules—into a single scalable interface.
- **High-speed data transmission.** Across industries, the intense growth of data-intensive applications is driving demand for Gigabit data transmission with lower latency. Connectors must maintain high performance while reducing crosstalk, as well as operate in harsh environmental conditions with high vibration, mechanical shock, and hundreds of thousands of mating cycles.
- **High power.** The demand for connectors capable of handling higher current levels is similarly driven by modern applications, such as battery management and power distribution systems.
- **Advanced test equipment.** Testing equipment plays a vital role across various stages of the product development lifecycle in ensuring that products meet quality standards, regulatory requirements, and customer expectation. As electronic systems become more complex, the need for enhanced testing and measurement equipment has grown.

Modular connectors provide significant value in meeting the market's evolving requirements by streamlining electronic system design while delivering high reliability, flexibility, and scalability across a wide range of industries.

Smiths Interconnect's L Series modular connectors simplify design challenges.

Smiths Interconnect's L Series is a premium, flexible, and reliable modular connector solution capable of meeting the demanding needs of next-generation electronic systems while simplifying the engineering design process.

L Series connectors offer several major advantages in modern electronics systems design.

Modular design

The L Series uses a building-block principle with two main elements—modules and frames—allowing flexible configurations for signal, power, coaxial, pneumatic, and high-speed data technologies. This building block approach supports scalability, enabling applications from small to large.

Simplify Your Designs with Modular Connectors

Versatility and customization

Customers can mix and match multiple modules (various connection types) within a single frame.

High reliability

L Series modular connectors use hyperboloid contacts to ensure durability for high-vibration environments, providing resistance to vibration, shock, and fretting corrosion. The connectors support up to 100,000 mating cycles, reducing downtime and increasing mean time between failures.

> "In a mission-critical application, even the slightest . . . poor connection and EMI can lead to intermittent packet loss. For both Cat5 and Cat6 connectors, they might actually suffer from signal degradation or even crosstalk during testing, especially with high frequencies. Maintaining some form of consistency in signal transmission is therefore absolutely paramount."
>
> – *Joydip Sanyal, Smiths Interconnect*

Enhanced data capability

Smiths Interconnect recently launched its Cat5e and Cat6A modules, developed in compliance with IEEE 802.3 standards. These modules combine hyperboloid contact technology with high-quality polycarbonate insulators for industry compliance and performance.

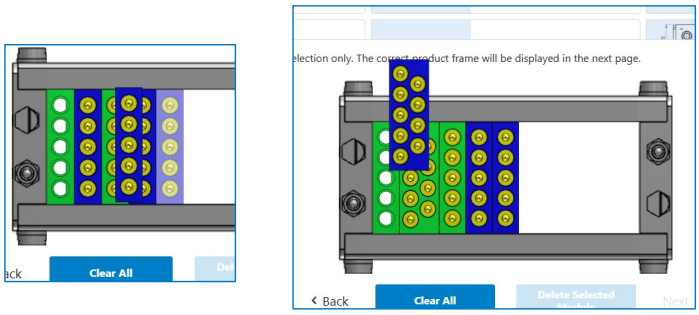
Figure 1: Smiths Interconnect Cat5e and Cat6A connectors

Ease of configuration

The Smiths Interconnect online configurator enables users to create customized configurations quickly and accurately. Engineers select standard components, including connector type, frame, frame length, modules, and termination type before arranging the module sequence using an easy drag-and-drop interface.

To facilitate collaboration among design teams and accelerate product development, the configurator supports multiple downloadable formats for saving and reloading configurations.

Figure 2: Online configurator allows users to easily drag-and-drop modules for faster design



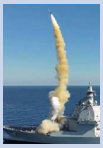
The L Series enables applications across industries.

The versatility of the L Series allows it to serve a wide range of industries, though there are specific applications in each industry for which these modular connectors are best suited. For example, in Aerospace & Defense mission-critical environments, the reliability provided by modular connectors is paramount. The L Series is especially valuable in applications such as C4ISR systems, power distribution units, ground stations and tactical operations centers, missile and launcher systems, and naval platforms.

In the test & measurement industry, the L Series is widely used for functional-test interconnects for aircraft and satellite subsystems, rack-and-panel mass interconnects, and end-of-line production testing, calibration, and diagnostic harnesses.

In the transportation and industrial automation sectors, L Series connectors support applications such as battery management systems, rail and electric infrastructure, autonomous mobile robots, and semiconductor burn-in testing equipment

Figure 3: Examples of target applications for the L Series modular connectors

Market	Application	
Rail	Rack & Panel Applications	
Semiconductor test	Test & Burn-In Systems	
Defence	Missile launch control systems	
Defence	Test benchs for airborne devices	
Industrial	Automotive test equipment	
Industrial	Cash deposit machines	

Simplify Your Designs with Modular Connectors

The L Series uses modularity to "future-proof" system design.

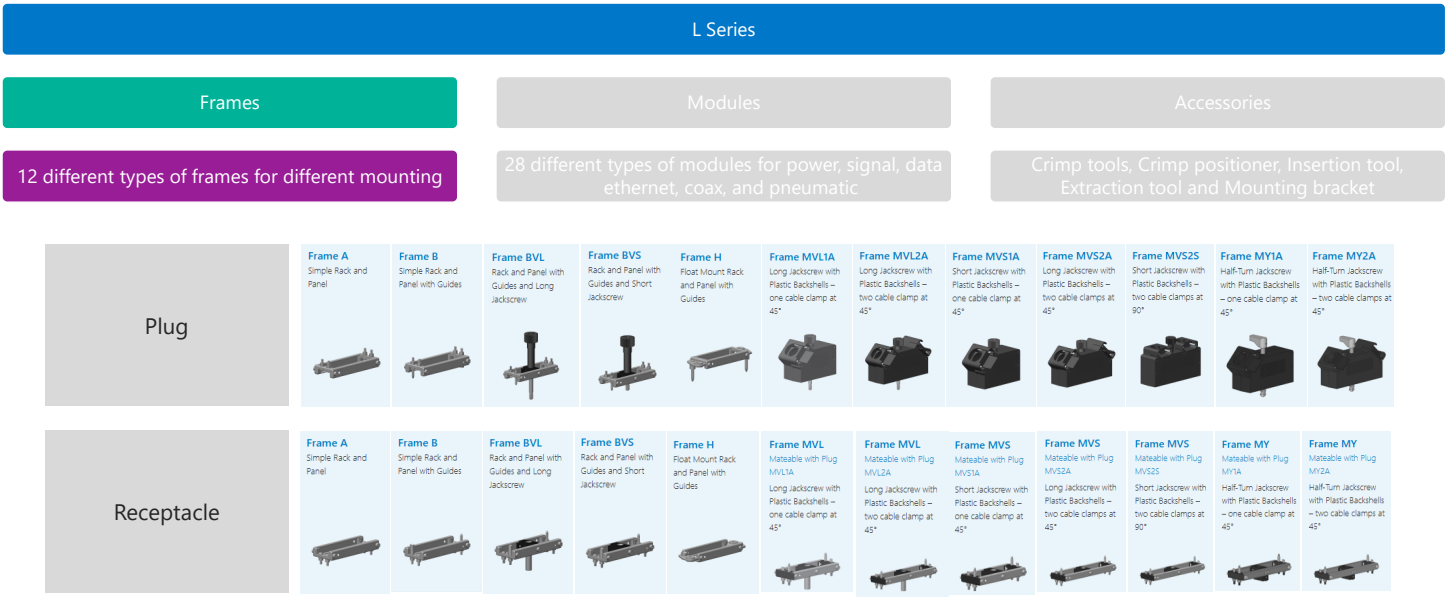
The L Series connectors are based on a building-block architecture, allowing designers to configure connectors tailored to specific application requirements. This flexible, configurable, mix-and-match architecture enables designers to combine signal, power, data, fiber optics, and pneumatic modules within a single connector. And because L Series modules share a standardized form factor, systems can be upgraded without redesigning the entire connector. This modularity "future-proofs" designs, enabling support for evolving technological demands and reducing costs.

L Series systems comprise three main components:

Frames provide mechanical structure and mounting options.

The series offers 12 frame options to ensure compatibility with a wide range of mounting requirements, including plastic protective hoods with multi-turn or half-turn jackscrews for secure engagement. Guides provide alignment for contacts and mounting to a device for advanced blind mating in rack-and-panel applications, while the floating mounts compensate for misalignment.

Figure 4: L Series mounting frame types

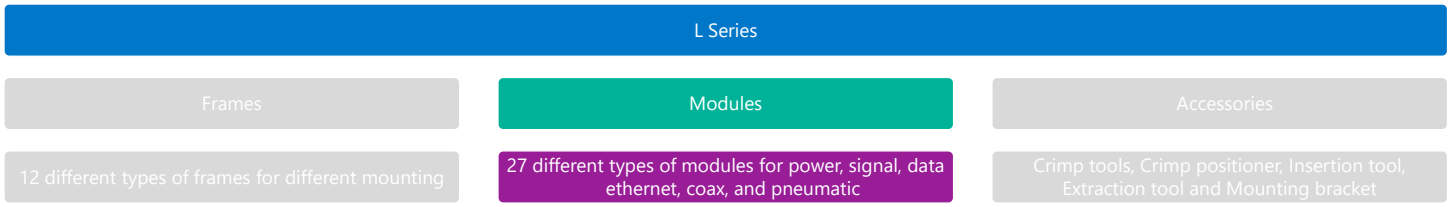


Modules house electrical or pneumatic contacts.

The L Series includes 27 module types, with additional modules in development. Modules also support different safety and compliance standards, such as UL and EN fire and smoke regulations, enabling their use in regulated industries such as rail infrastructure and aerospace.

The L Series currently supports up to 200 amps, with future development planned for 400 amps.

Figure 5: L Series modules



Module	No. of ways	Current rating (A)	Rated voltage (V)
A/RA	5	8	250/160
B/RB	3	15	200/160
C/RC	2	25	320/250
D/RD	17	8	200/160
E/RE	9	8	250/200
F	2+1	FO+COAX/POWER	
G	1	200	400
H/RH	2	COAX	
K	1	100	400
K4	4	100	250
M/RM	2	50	320/250
N	2	15	400
PN	2	AIR	

Module	No. of ways	Current rating (A)	Rated voltage (V)
Q/RQ	9	8	200/160
RR	5	8	32
RR	5	8	160
RS	3	15	160
RR1	5	8	80
S	3	15	320
T/RT	5	8	320/200
U/RU	2	25/50	630/250
V	3	COAX	
V	3	25	250
W	28	4	80
Z1/RZ1	2	50/25	320/400
CAT5e	1	Ethernet	
CAT6a	1	Ethernet	

Accessories include hoods, locking arrangements, and alignment hardware.

To accommodate various manufacturing processes, modules support multiple termination methods, including crimp, solder cup, dip solder, and wire wrap. Best practices recommend maintaining consistent termination types within a single connector to simplify assembly and ensure reliability.

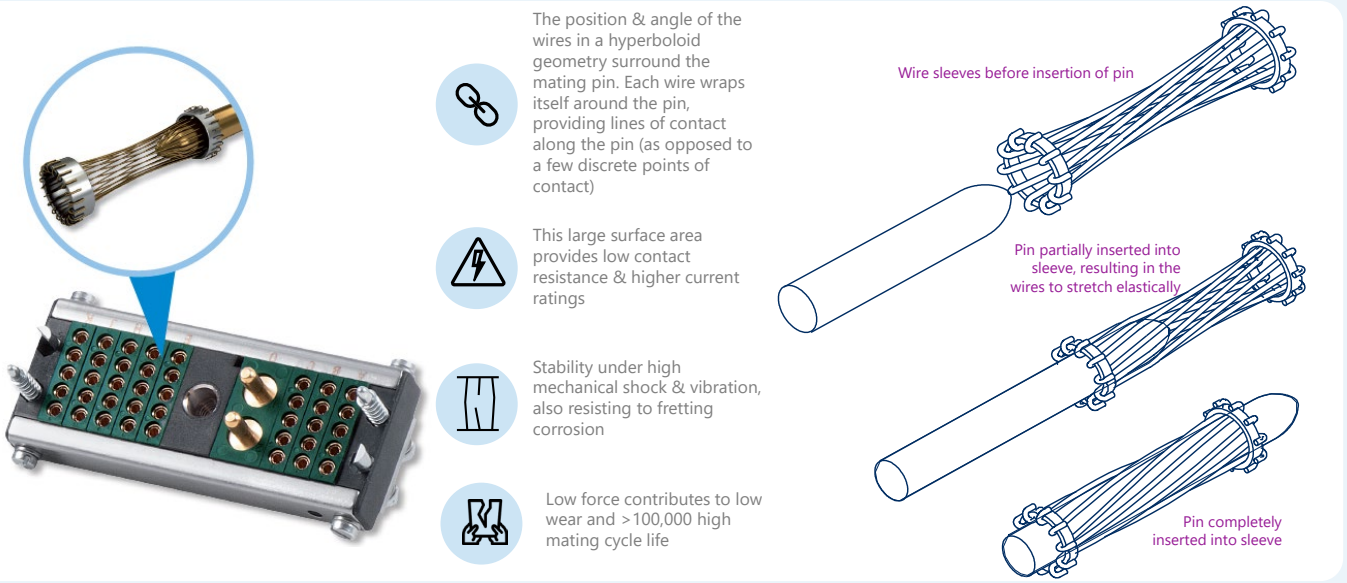
Hyperboloid contacts enable mission-critical applications

The L Series hyperboloid contact technology is what enables high reliability—and what sets the L Series apart from conventional connector designs.

Hyperboloid contacts consist of gold- or silver-plated fine wires arranged in a hyperbolic geometry. When a male pin is inserted, these wires wrap around it, creating a 360-degree electrical connection. The low mating force enables high-density connector configurations, while the elasticity of the hyperboloid wire "basket" allows the male pin to move slightly without damaging the contact surfaces. This design enables stability under high mechanical shock and vibration, significantly mitigating fretting corrosion.

Hyperboloid contacts have low contact resistance and a long operational life, making the technology particularly valuable in mission-critical and high-performance applications.

Figure 6: Hyperbolic contacts offer significant advantages over traditional designs



Smiths Interconnect's strong industry partnership with TTI ensures supply chain reliability.

Efficient supply chain support is facilitated through Smiths Interconnect's close partnership with TTI. A reliable distributor, TTI maintains substantial inventory and provides rapid turnaround for many configurations, enabling customers to reduce lead times and fulfill almost any configuration requirements quickly.

With easy access to technical support, the collaboration between Smiths Interconnect and TTI enhances customer experience and supports efficient project execution.

ADDITIONAL INFORMATION

To learn more, visit Smiths Interconnect from TTI, Inc.

BIOGRAPHIES

Joydip Sanyal

Product Group Mgr., General Industrial and Aerospace and Defense - Connectors BU
Smiths Interconnect, a Molex company

Joydip Sanyal is a Chartered Mechanical Engineer with 18-plus years of experience in the industry. He is currently responsible for providing strategic direction for product line development, product and technology roadmap creation and market penetration.

Jerilynn Johnston

Distribution Manager, Americas
Smiths Interconnect, a Molex company

Jerilynn Johnston is the Distribution Manager for the Americas at Smiths Interconnect, playing a key role in shaping the company's distribution strategy across the region. She leads strategic distribution operations, strengthens the TTI partnership, and drives impactful supply chain alignment to support growth and customer success.

With a career in electronics distribution spanning more than two decades, Jerilynn has been committed to advancing channel performance and partner collaboration across the industry