INTERCONNECTS FOR IOT APPLICATIONS

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MIDLOTHIAN, 4TH JUNE 2021

Internet of Things

Industrial Revolution and Connector Development

First Light Bulbs, Power Station & Telephone

1904:
First separable connector invented

Backplane Connector is born!

WWW is invented

5G and Internet of Things

1880's | 1920's | 1960's | 1980's | 1990's | 2000's | 2020's

Cars, Radio and Television Transmission

Personal Computers explode on the scene

High Speed Connectors for Internet

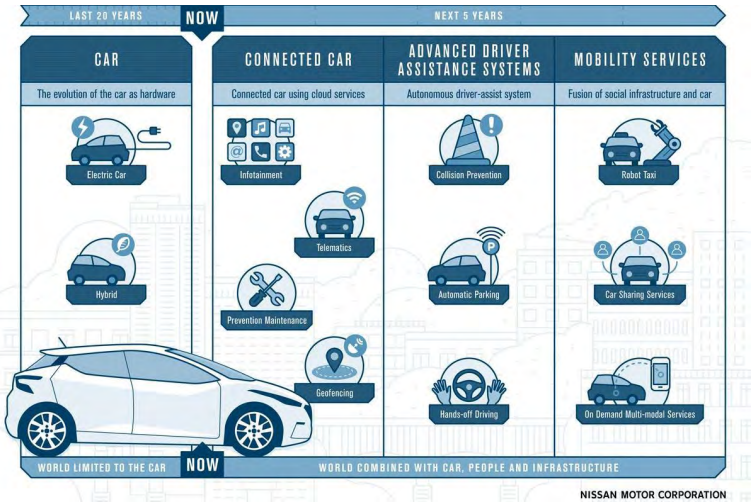
2nd Industrial Revolution | Digital Revolution – 3rd Industrial Revolution | Industry 4.0

This Internet of Things

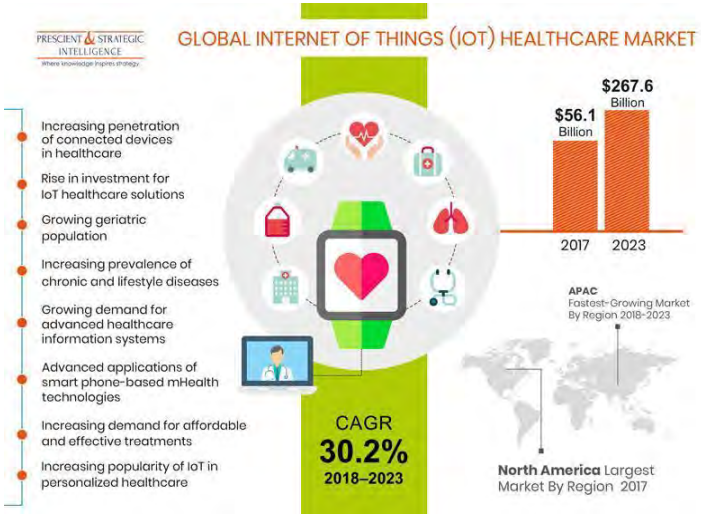
It truly is everywhere

Community

Work



Mobility



Healthcare

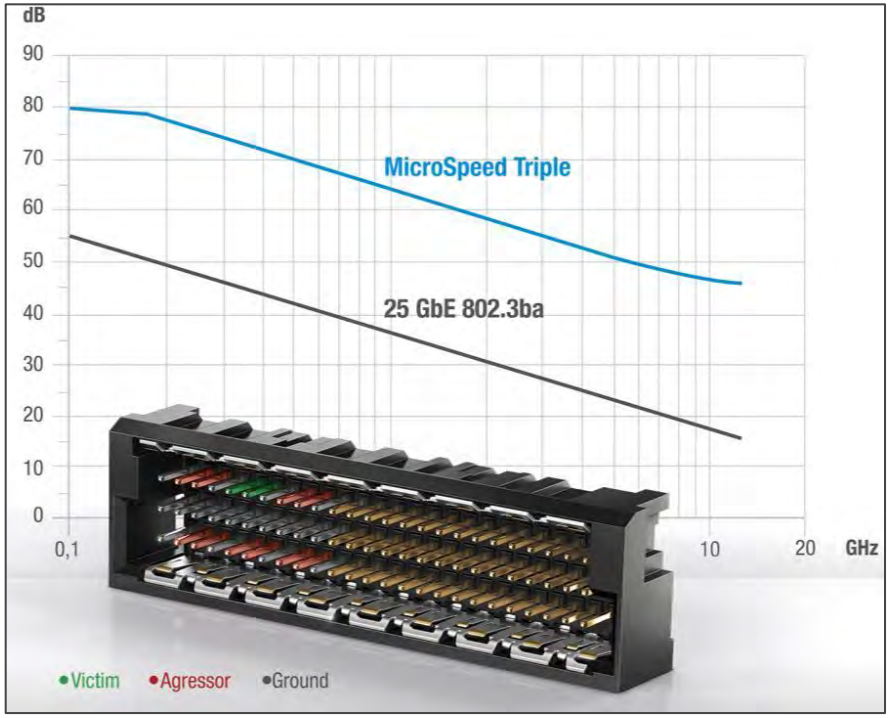
Key IoT Connector Challenges

High Speed Connections

- Applications where data rates exceed 10Gb/s
- Impedance matched to minimize signal distortion
- Low near end and far end crosstalk

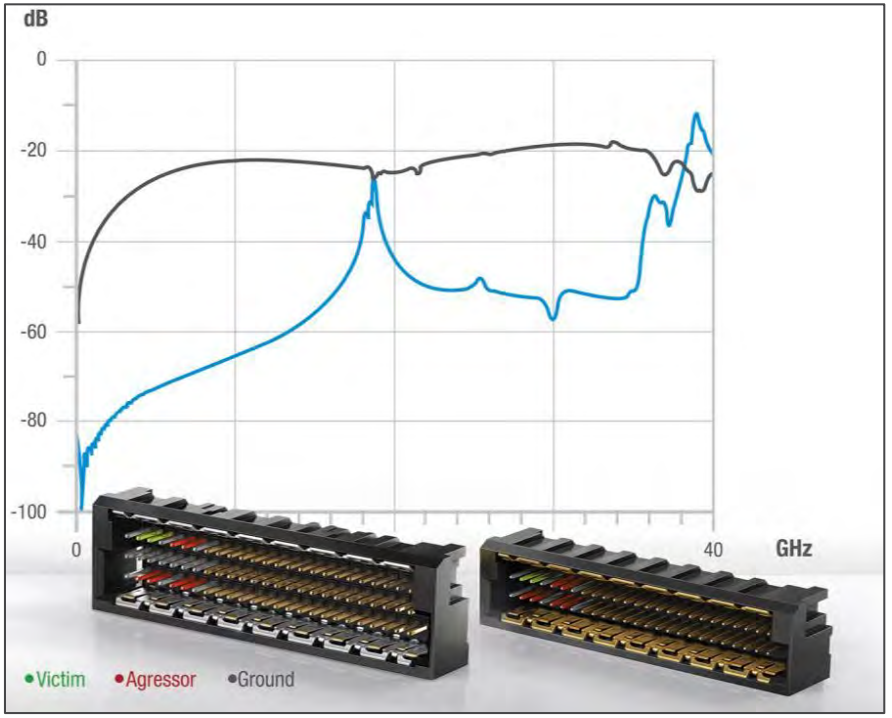
IoT Connector Challenges

High Speed Connections



Insertion Loss

- Next-generation platforms demand optimal signal integrity performance when routing high-speed signals.
- Flexible pin layouts to optimize and match impedance of the system (50/85/100 Ohm)



Cross Talk

- Various signal-to-ground patterns meet individual crosstalk requirements (NEXT, FEXT) and hence maintain signal integrity

Key IoT Connector Challenges

High Speed Connections

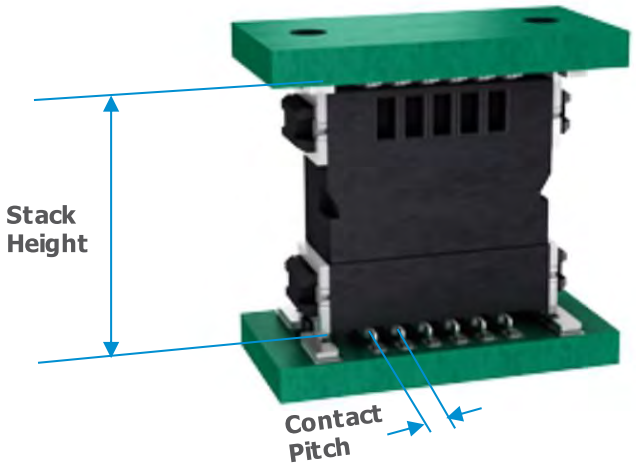
- Applications where data rates exceeding 25Gb/s
- Impedance matched to minimize signal distortion
- Low near end and far end crosstalk

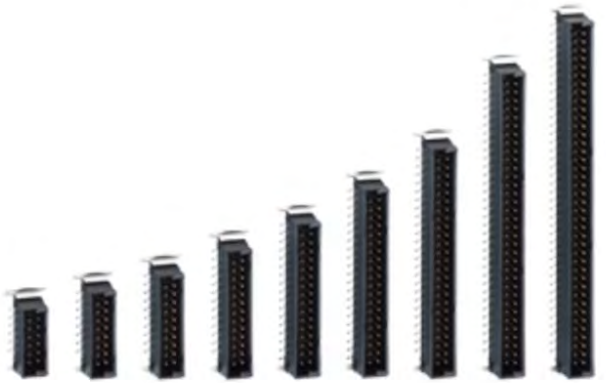
Small Scalable Footprints

- High Density connections with fine pitch SMT components
- Flexible pin counts and stacking heights
- Signal routing optimization

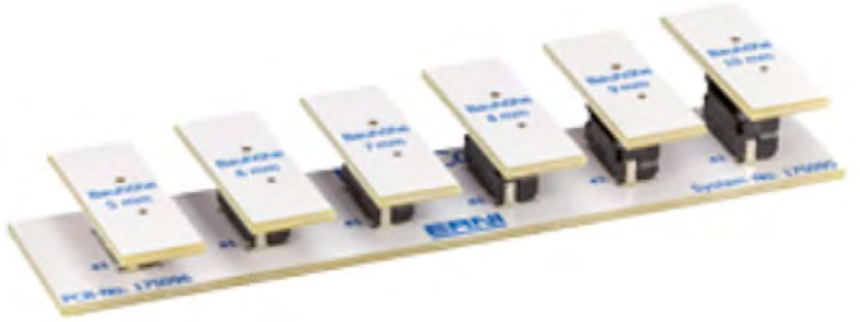
IoT Connector Challenges

Small Scalable Footprints



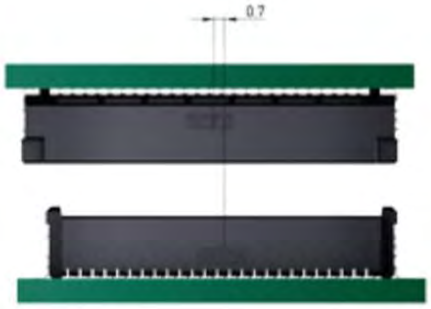


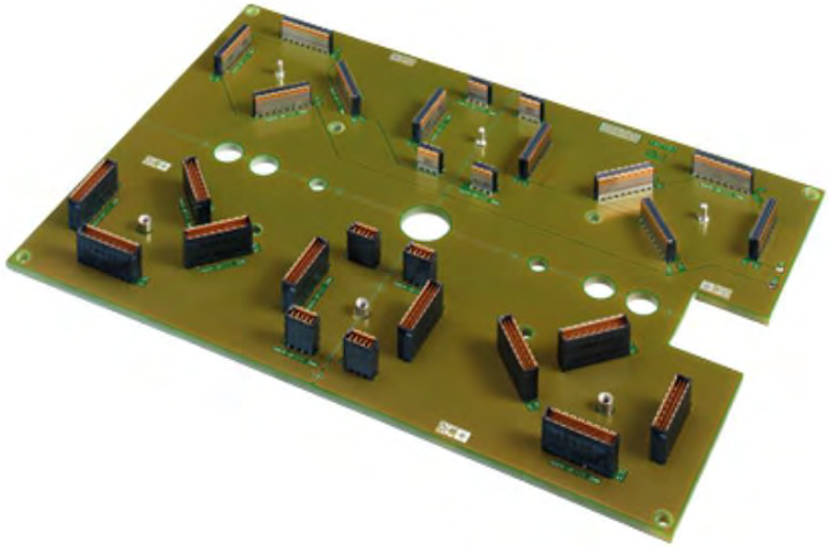
- **Pin to pin spacing as small as 0.8mm**
  - High density when needed
  - SMT flexibility
- **Flexible board to board stacking heights**
  - Able to adapt design based on other PCB component heights
- **Diverse pin counts**



IoT Connector Challenges

Small Scalable Footprints





Multiple connector solutions

- **Misalignment tolerance**
  - X, Y & Z-axis
  - Angular inclination
- **Routing flexibility**
  - Localized connector placement = shorter runs

Key IoT Connector Challenges

High Speed Connections

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Small Scalable Footprints

- High Density connections with fine pitch SMT components
- Flexible pin counts and stacking heights
- Signal routing optimization

Improved Robustness and Reliability

- Mechanically and Electrically reliable in a wide range of applications
- Ease of assembly by the end user
- Fool Proof designs

IoT Connector Challenges

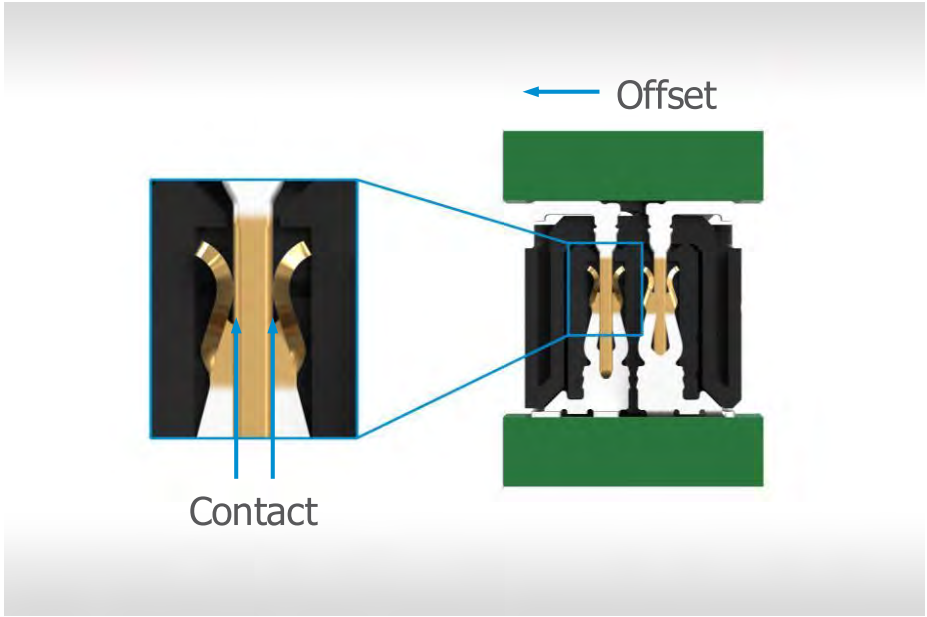
Reliable connector interfaces

Interface / Mating Face

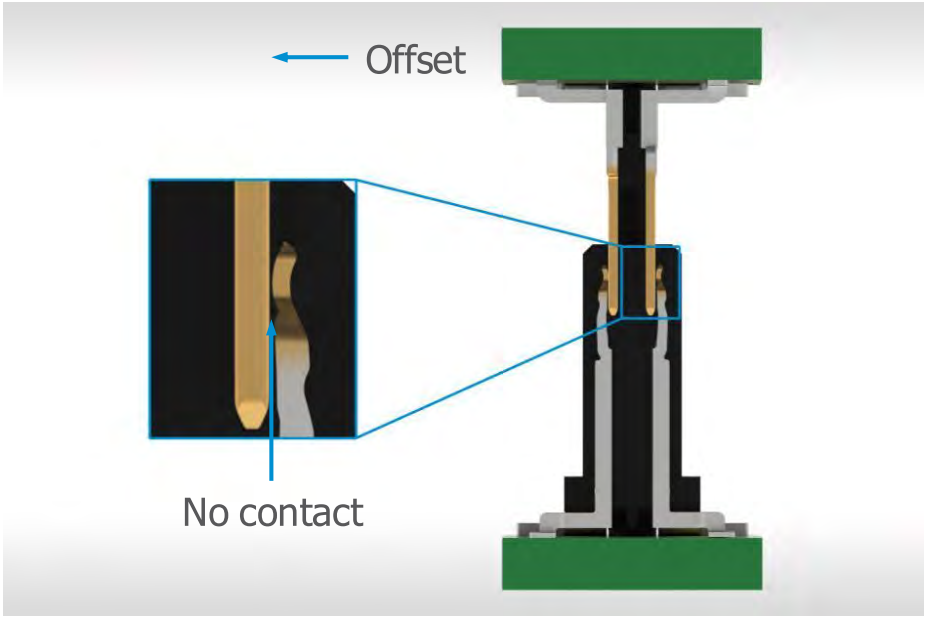
- High temperature plastic materials to withstand lead-free reflow profiles.
- Geometrically robust designs that allow precise location of contacts in the housing.
- Long contact wipe lengths
- Lubrication for high vibration environments (fretting corrosion)
- Dual sided female contacts with durable plating solutions

IoT Connector Challenges

Dual Sided Contact Example



Double-side female contact: In case of misalignment contact guaranteed



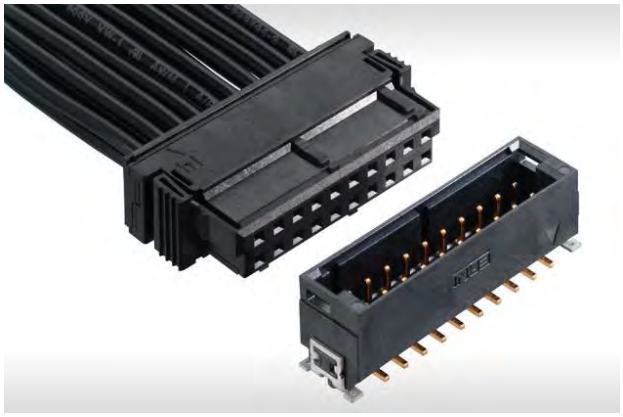
Single-side female contact: In case of misalignment no contact guaranteed

Connectors with single-beam contacts occasionally lead to tolerance problems when mating.

Mezzanine connectors designed for use in IoT applications should employ field-proven dual-beam, spring contact designs

IoT Connector Challenges

Ease of Assembly



- Color and/or mechanical coding to ensure that the appropriate connections are made
  - Separate connections for different voltages or safety requirements
- Polarization and blind mate features to ensure proper orientation at mating
  - Poka-yoke [mistake proofing]
- Clips, latches and locking features for contacts and housings
  - End users don't always follow instructions and abuse the products.

Select IoT Market Application

SMART Cities, Buildings & Homes

- Traffic routing
- Parking
- LED street lighting with environmental detectors
- HVAC 4.0 using Active Energy Management (AEM)
- Home security; appliances

Manufacturing

- SMART Factories
- Autonomous manufacturing
- Real time diagnostics
- Machine monitoring
- Inventory management

Transportation

- Autonomous vehicles
- Real time diagnostics
- Driver monitoring
- Predictive maintenance
- Insurance

Healthcare

- Reduced latency can lead to remote surgery
- Telemedicine
- Wearable health monitors

"In our discussions with our customers, it's clear that IoT and 5G are now components of the same strategic discussion."
– Lisa Taylor, Head of IoT Marketing, Ericsson

"IoT technology is the fourth industrial revolution"
- Gillan Taddune, CEO of Banyan Water

ERNI Solutions for Smart Cities, Buildings and Homes

Cameras

Sensors

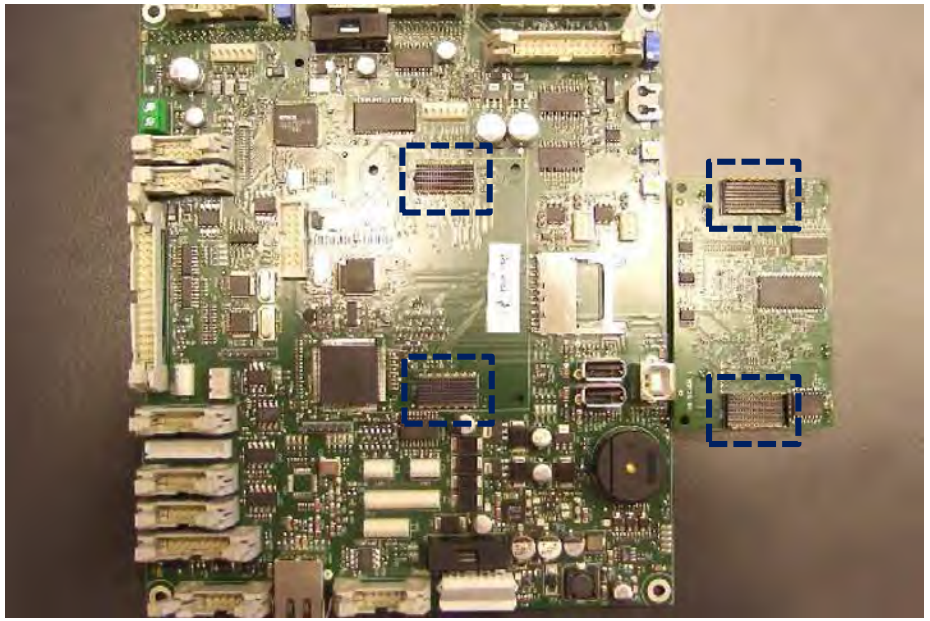
Data Management

Lighting

The global IoT in smart cities market size is expected to grow from USD 113.1 billion in 2020 to USD 260.0 billion by 2025, at a Compound Annual Growth Rate (CAGR) of 18.1% during the forecast period

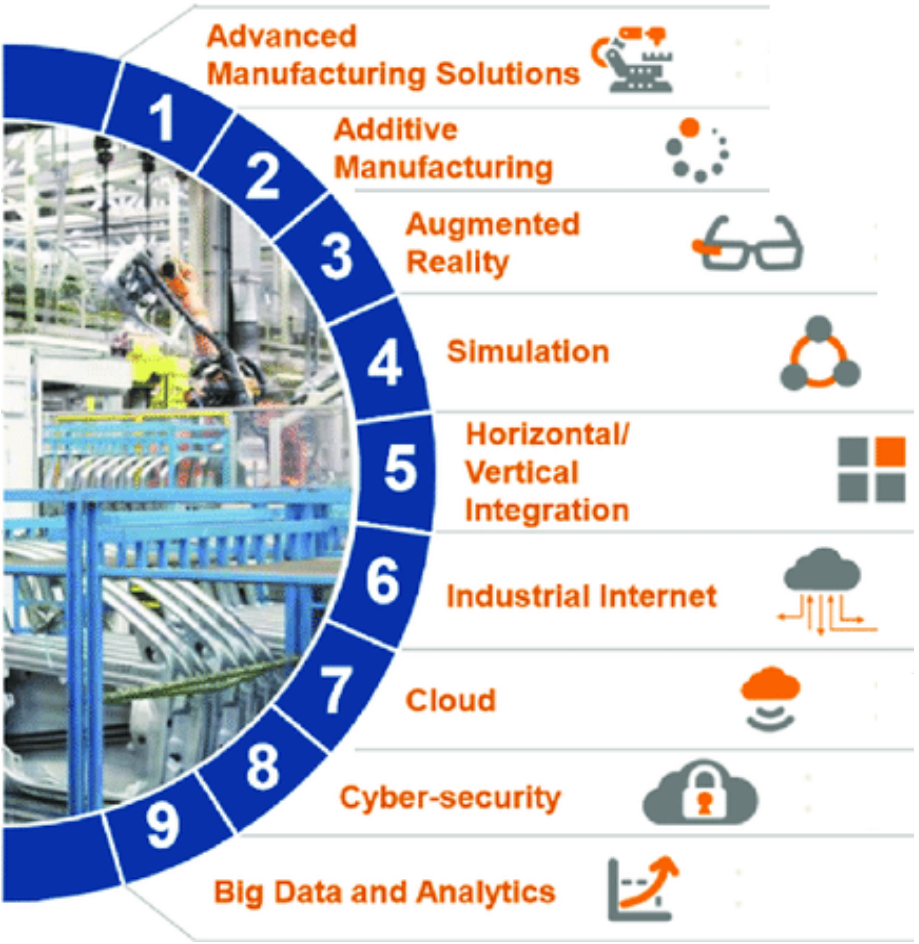
Connected cities

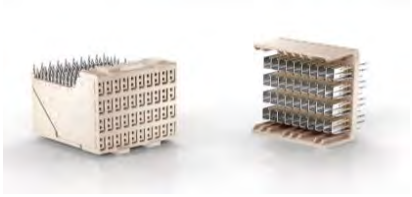
A **parking meter** customer needed a robust, miniature solution that held a smaller footprint on the PCB yet was highly dense.



ERNI's MicroSpeed with a 133 pins was just the choice. This 1.0mm pitch connector delivers up to 1A per contact plus 25+ Gbit/s. The pronounced pre-alignment and a blind mating option make for easy assembly plus a high degree of forgiveness when technical support to the product is needed.

IoT and the Smart Factory (Industry 4.0)





SMART Factories

- **Improved latency**
  - More precise control
- **Increased Bandwidth / Speed**
  - More information can be transmitted
  - HD Video
- **Local data processing**
  - Edge networks to process data and analytics
  - Cloud data storage

Global Smart Factory Market is set to grow from $75 billion to over $155 billion by 2025.
- Global Market Insights, Inc.

ERNI Solutions for SMART Factories

Embedded Sensors

Machine Vision

"Voice of the Machine"

Various IIoT Applications

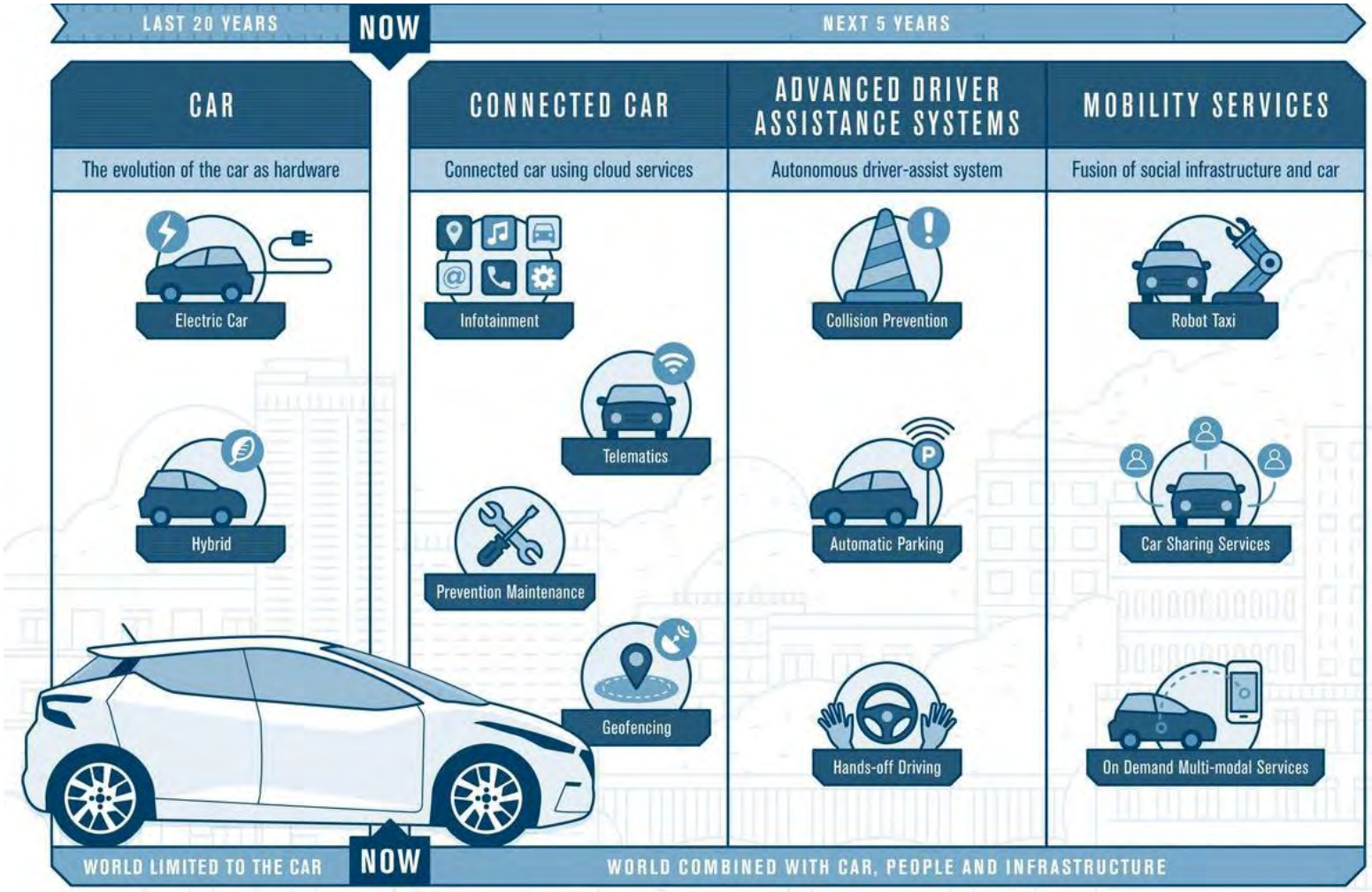
Machine Vision & Sensors
- Color sensors
- IP Camera systems
- Encoders

Industrial Controls
- PLC, DCS
- Machine control systems
- Low power servo drives
- Industrial computers / Switches

Robotics

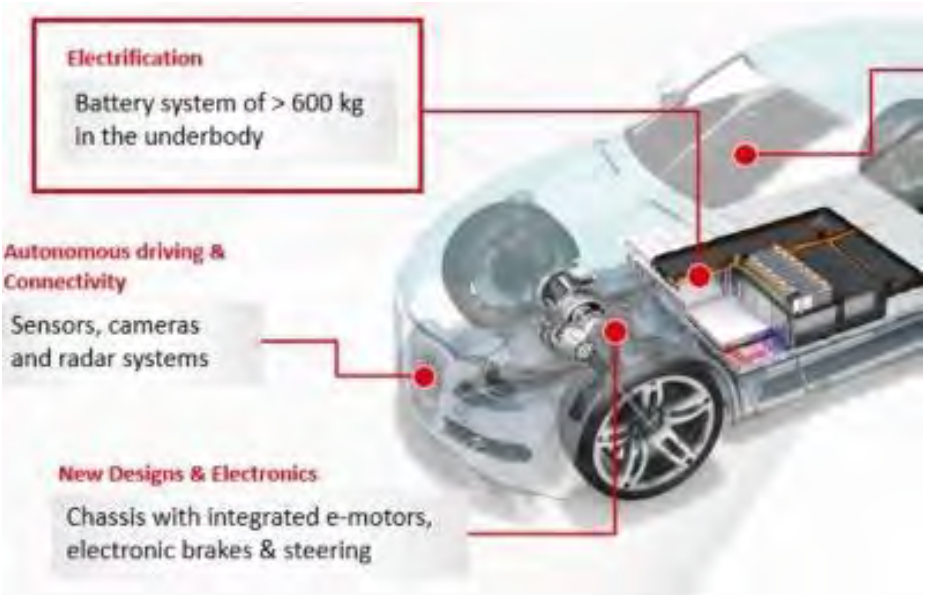
ERNI Solutions for IoT Connected Vehicles

The global connected car market size in the pre-COVID-19 situation was projected to reach USD 180.9 billion by 2025, from USD 63.2 billion in 2020



NISSAN MOTOR CORPORATION

Connected and electrified vehicles

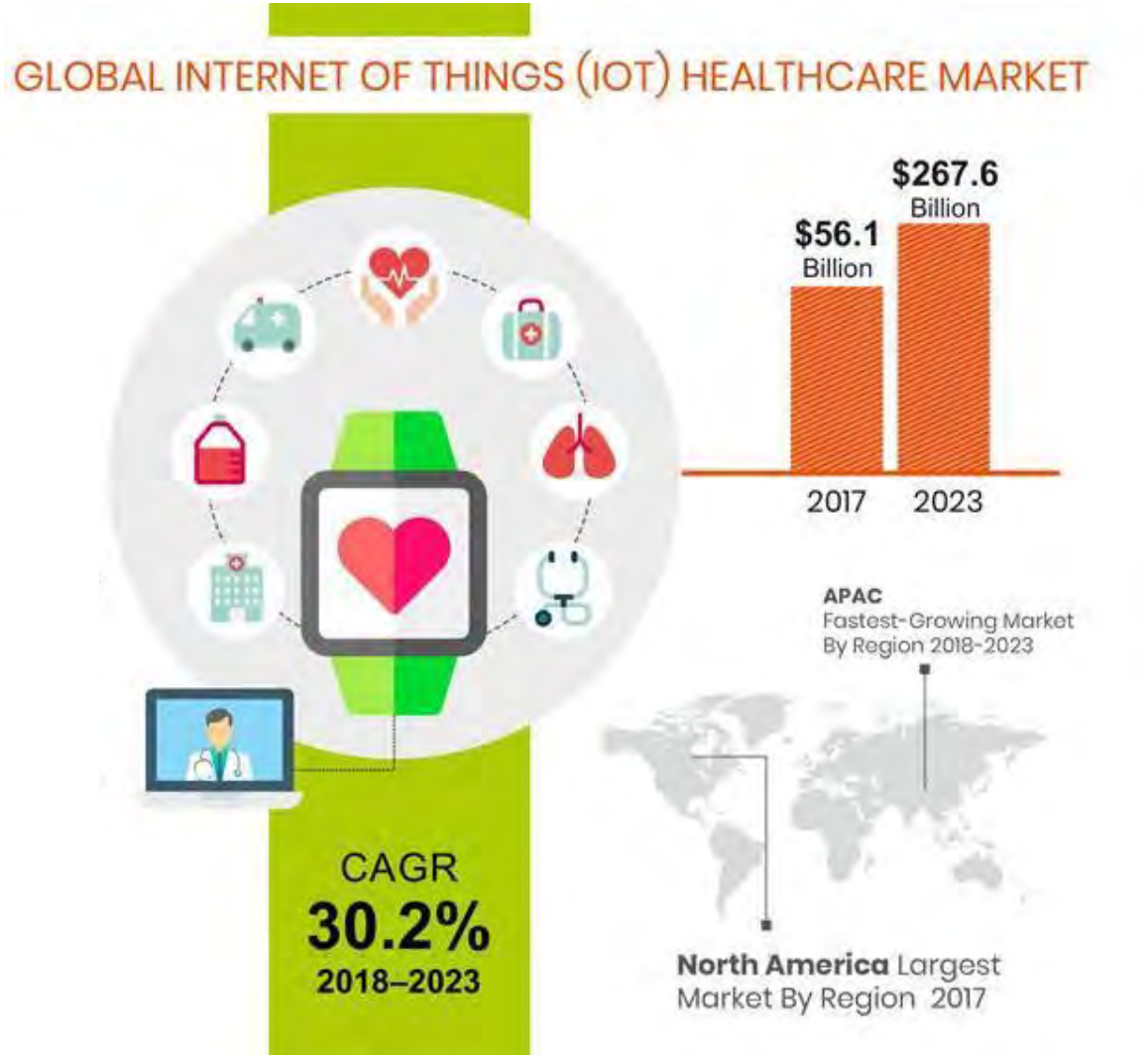


Today's modern vehicles are more connected and electrified than ever before. One important component to the electrification is an **inverter**, an inverter is an electrical device that converts electricity derived from a DC (Direct Current) source to AC (Alternating Current).

ERNI was able to deliver a combination solution for this inverter customer with the MicroBridge and SMC. The small PCB footprint required for each of these 1.27mm pitch connectors was very attractive as are the board-to-board connections and qualifying certifications.

ERNI Solutions for IoT Healthcare

Infant Monitoring
Sleep Monitoring
Clinical Efficiency
Biometric Sensors
Fitness Wearables
Consumer / Home Monitors
Brain Sensors / Neurotechnology



ERNI

IoT for Healthcare Application

Healthcare devices are continuing to become interconnected at every level. These units need to rugged, mobile and ready to transmit critical information.

ERNI was able to provide a combination solution for this Medical customer with the ERmet and SMC families. The ERmet provided an important standardized interface to the CPCI backplane, while the small PCB footprint and multiple configurations of the 1.27mm pitch SMC connector allows for inside the box flexibility.

Fast…

Scalable…

Reliable…

ERNI

ADDENDUM

ERNI for IoT

Product Family Overview of MaxiBridge

ERNI's MaxiBridge

Configuration

Key Buying Factors include

Current rating up to 12 A per contact

Discrete wire crimp contacts 18 – 26 AWG

Terminal Position Assurance (TPA)

Side latching connection

High temperature resistance

Based on LV214 and USCAR-2 automotive specifications

Low z-height for right angled males

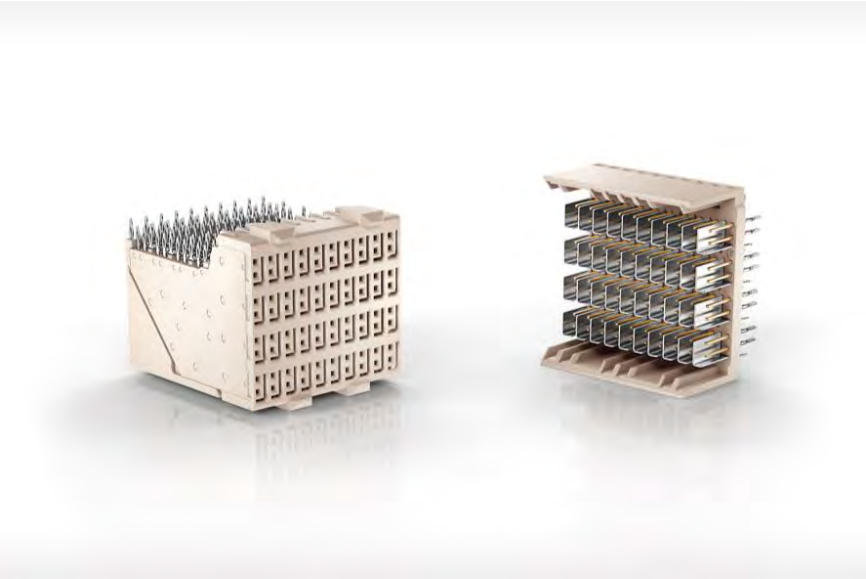
The MaxiBridge connector system is a single- and double-row cable connector system with a pitch of 2.54 mm. It has a high current rating of up to 12 A per contact and is ideal for space-saving, highly stressed connections.

ERNI's MaxiBridge has a compact design in a 2.54 mm pitch size, with low z-height and capable of up to 12 A per contact, making MaxiBridge a flexible solution capable of meeting objections for many applications. MaxiBridge can operate in temperatures up to 150ºC with a high degree of performance plus low and high voltage applications can be managed with this versatile connector.

Learn more about MaxiBridge — Landing Page, Video, Flyer

ERNI for IoT

Product Family Overview of ERmet ZD



ERNI's ERmet ZD

Configuration

Key Buying Factors include

Data rates over 25 Gbit/s

0.9 A per contact

Used with ERmet 2 mm HM and UPM

Excellent signal integrity

Differential signal pairs per shield

Inverse variants available

2 pair, 3 pair, and 4 pair versions

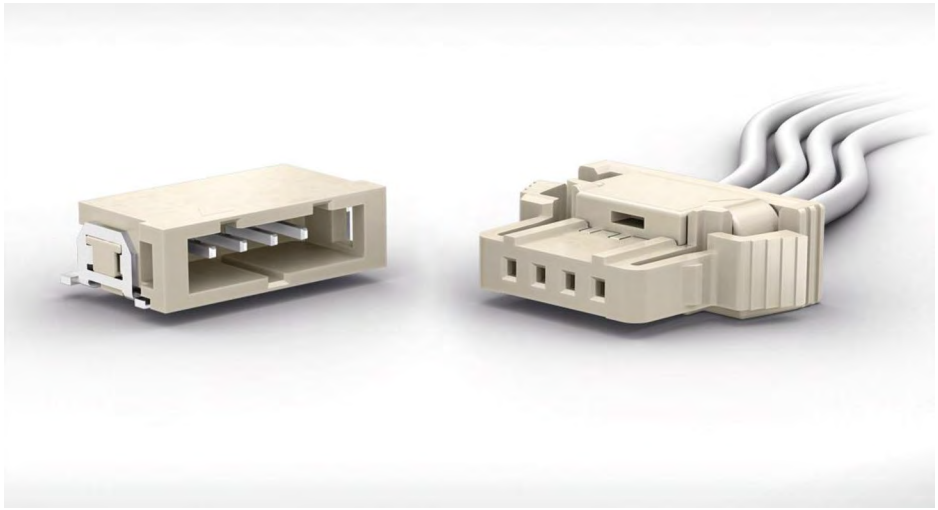
Demanding applications with high data transmission rates can be realized with connectors from the ERmet ZD product line. The ZD family of connectors have a robust design with identical connector mating faces that are compatible within this family. The ERmet ZDPlus and ZDPro variants allow data rates from 20 or 25 Gbit/s.

ERNI's ERmet ZD high speed differential signal pair connector system can be applied in the same backplane slot as 2 mm HM, ERmet B08, ERmet Power Module UPM and even DIN 41612 connections.

Learn more about ERmet ZD Landing Page

ERNI for IoT

Product Family Overview of iBridge Ultra



ERNI's iBridge Ultra

Configuration

Key Buying Factors include

Current rating up to 8 A per contact

Discrete wire crimp contacts 22 – 24 AWG

Terminal Position Assurance (TPA)

Side latching connection

Tin (Sn) contact plating

Conforms to USCAR-2 / USCAR-21 automotive specification

The iBridge Ultra connector family offers extensive wire-to-board solutions. Designed for applications needing reliable and robust connection systems, a TPA (Terminal Position Assurance) retainer serves as a secondary lock for the female contact in the housing.

ERNI's iBridge Ultra is a 2.0 mm WtB connector system designed to perform in harsh environments. With up to 8A per contact, iBridge Ultra is double-sided interlocking, with pin counts from 2 – 12, has both SMT and solder termination styles, and AWG of both AWG22 and 24 for cable assemblies, making it flexible, reliable and a easy to adopt connector solution.

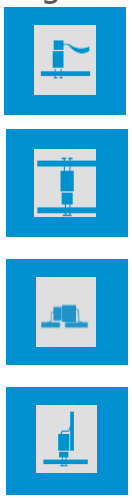
Learn more about iBridge Ultra — Landing Page, Video, Flyer

ERNI for IoT

Product Family Overview of SMC

ERNI's SMC

Configuration



Key Buying Factors

Up to 1.7 A per contact

Stacking height of 8 to 20 mm

Board to board extenders to 40 mm

Rugged SMT PCB anchoring

Dual beam female spring contact

Position sizes between 12 and 80

Data rates to 3 Gbit/s

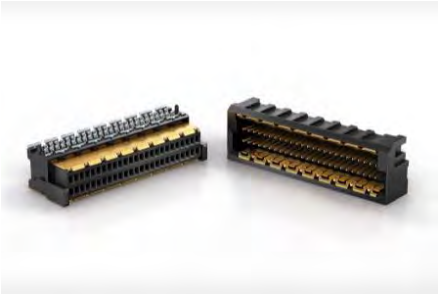
Introduced in 1989 as an SMT connector system, this small yet rugged two row 1.27 mm connector system has developed into an extensive product offering. SMC has become the solution for electronic designers for its ruggedness and versatility.

ERNI's 1.27mm pitch SMC connector series is robust, versatile and easy to install. With up to 40mm BtB height with an adapter, higher flexibility, quality and security are met with a lower cost of production. The SMT termination also contributes to less time for assemble and no need for thermal stress on the PCB. Additionally, up to 24 ERNI SMC connectors can be mounted to a single board without loss of signal integrity.

Learn more about ERNI's SMC Landing Page, Video, Flyer

ERNI for IoT

Product Family Overview of MicroSpeed



Configuration

Key Buying Factors include

Misalignment tolerance up to 0.27 mm

Up to 25 Gbit/s signal; 18A power

Blind-mate solutions available

Reliable female dual-beam spring contact

Stacking heights 5 to 20 mm

Robust integrated EMC shielding

ERNI's MicroSpeed Signal

The MicroSpeed Signal 1.0 mm pitch connector system is a guarantee for high data transmission rates. The space-saving, interference-proof connectors are maximally electromagnetically compatible and safe. MicroSpeed Power Module Module is miniaturized at 2.0 mm pitch yet delivers up to 18 A per contact. Designed to ERNI's stringent standards, the dual-beam female contacts are durable and reliable with 3-points of contact.

ERNI's MicroSpeed series has excellent EMC shielding with flexible board to board options in an open pin field configuration. Available with different stacking heights with pronounced pre-alignment for blind-mate applications.

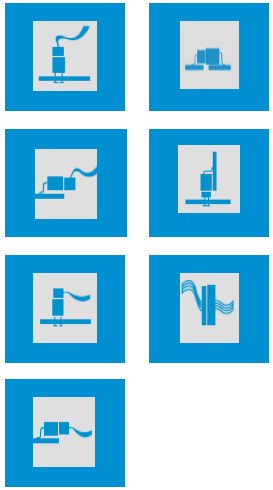
Learn more about ERNI's MicroSpeed Landing Page, Video, Flyer

ERNI for IoT

Product Family Overview of MiniBridge

ERNI's MiniBridge

Configuration



Key Buying Factors include

- Up to 8.7 A per contact
- Compact cable mating system
- Connector Position Assurance
- High temperature tolerance up to 150ºC
- Low height for angled males
- High vibration and shock load
- Fast processing 90º IDC female cable connector

The ERNI MiniBridge connectors have a miniaturized shape in 1.27 mm pitch and can be used everywhere that space-saving connections between PCBs and decentralized functional units must be implemented as well as offer high mating reliability. The Koshiri option provides even further confidence in secure, scoop proof mating.

ERNI's MiniBridge's 1.27 mm pitch with 8.7A current carrying capacity delivers flexibility and cost savings in a compact design with a low height of only 3.6mm for right angled males. The female 90º female cable assembles also deliver savings for time to assemble with flexibility and optimum ease of installation. Security, flexibility, and ease of use are among MiniBridge's cost savings.

Learn more about MiniBridge — Landing Page, Video, Flyer

ERNI for IoT

Product Family Overview of Power Elements

ERNI's Power Elements

Configurations

Key Buying Factors

Current carrying capacity up to 500 A

High-current wire to board

Component fixation to board

Surface mount and press fit versions

Where high power must be supplied to PCBs, ERNI-Power Elements offer the right solutions. They not only transmit high current but are also tailor-made for high mechanical stresses. PowerElements are available for various applications in many variations.

ERNI's Power Elements are available in several PCB terminations to meet customer's expectations. Press-fit termination alleviates heat stresses that would otherwise occur if a solder termination were used. Two-piece versions prevent mechanical stresses and Surface mount (SMT) allows for faster processing of the PowerElements to the PCB.

Learn more about ERNI's Power Elements Landing Page, Flyer, Catalog

ERNI for IoT

Product Family Overview of M8 M12

ERNI's M8 M12

Configurations

Key Buying Factors

Comprehensive product offering

IP 65 & 67 rating when mated and locked

SMT and THR mount

Broad range of accessories

Right Angle versions for sensors pipes

Multiple coding options including X for industrial ethernet

ERNI's M8/M12 circular connector series is comprehensive. With codings from A to X and pin counts from 3-17, nearly every industrial application needing circular connectors can be met with one of ERNI's selections.

ERNI's surface mount technology (SMT) carries over to the M8/M12 product series, making assembly to the PCB easier and less costly than other termination options. With many variants, accessories and add-ons, rest assured your IP65 or IP67 rating is met with mated and locked ERMI M8/M12 connectors.

Learn more about ERNI's M8/M12 series Landing Page, Catalog

ERNI for IoT

Product Family Overview of MicroBridge

ERNI's MicroBridge

Configuration

Key Buying Factors include

Up to 9 A at 20 °C

Electrical CPA versions

Dual IDC contact per wire with strain relief

Side latching

Temperature resistant to 150 °C

Automotive scoop-proof design

2 to 14 positions possible

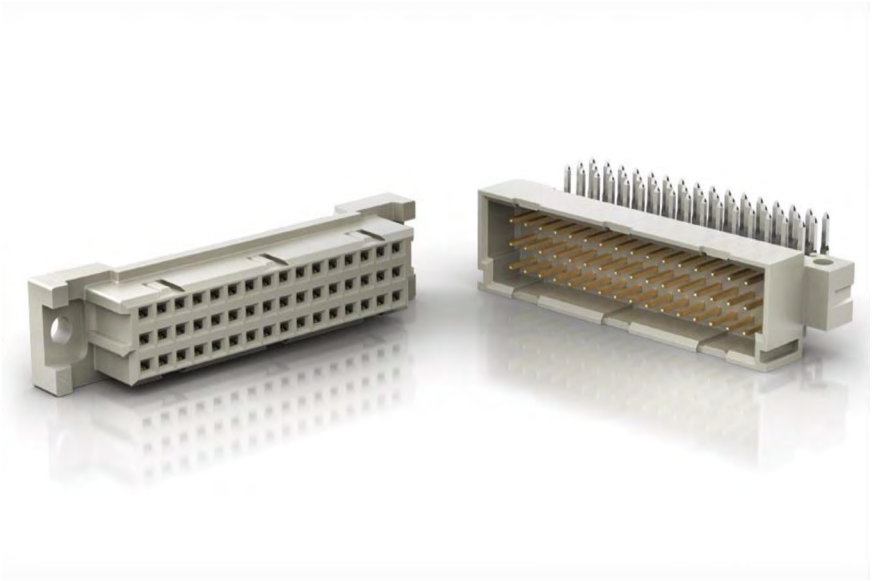
In developing MicroBridge 1.27 mm pitch connectors, ERNI took the requirements of its automotive sector customers into consideration and implemented Koshiri 'scoop proof' security and an optional electrical CPA (connector position assurance) for secure connections. With high temperature resistance of up to 150 °C, they can be used in high-heat applications like near LEDs in front headlights.

ERNI's MicroBridge was built to automotive standards yet the benefits of the is 1.27 mm robust connector can reach all industries. With an electrical CPA and 90º Female cable assemblies, this premium connector family has a high current carrying capacity of 9A per contact, operating in up to 150ºC yet is miniaturized with a height of less than 5 mm for the right-angled males.

Learn more about MicroBridge — Landing Page, Video, Flyer

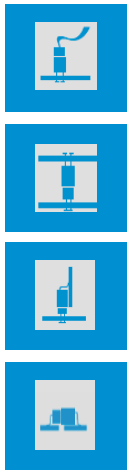
ERNI for IoT

Product Family Overview of DIN 41612



ERNI's DIN

Configurations



Key Buying Factors

Comprehensive product offering

ERNI dual beam female contact

Robust and reliable mating interface

Broad range of accessories

20 to 160 positions

Signal and Power versions

ERNI's DIN 41612 family of connectors has many accessories and variants that continues to make it the preferred connection for electronics and communication systems world-wide with both power and signal solutions as connectors and cable assembly components.

ERNI's product design and manufacturing quality continues to keep us at the forefront of the DIN 41612 connector industry as well as our conformance to the specifications to which they are built.

Learn more about ERNI's DIN — Landing Page, Catalog

ERNI for IoT

Product Family Overview of Modular Jacks

ERNI's Modular Jacks

Configurations

Key Buying Factors

Integrated magnetic versions

Power Over Ethernet (POE)

Data rate in the Gigabit range

LED options

Compliant with Ethernet standards

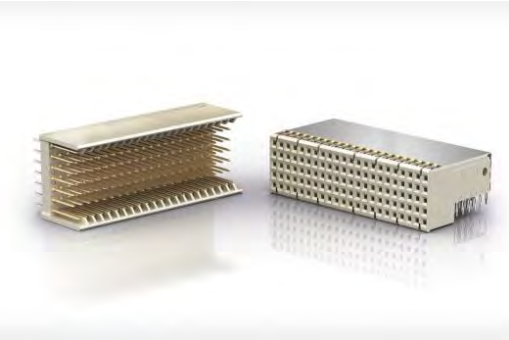
In the area of network and controls technology, modular connectors have proven themselves for many years. They facilitate making fast reliable connections with high bandwidth and have a simple, compact shape. Modular Jacks versions with integrated magnetics save valuable space on the PCB.

ERNI offers a wide range of Modular Jacks including versions with integrated magnetics. Many configurations exist for our standard Modular Jacks including stacked, ganged, single port, and couplers.

Learn more about ERNI's Modular Jacks Landing Page, Catalog

ERNI for IoT

Product Family Overview of ERmet HM



ERNI's ERmet HM

Configuration

Key Buying Factors include

Up to 1.6 A per contact

Press-fit technology

Comprehensive product offering

ERNI dual-beam female contact

5+2 and 8+2 versions

Data rates up to 2 Gbit/s

Design to IEC 61076-4-101

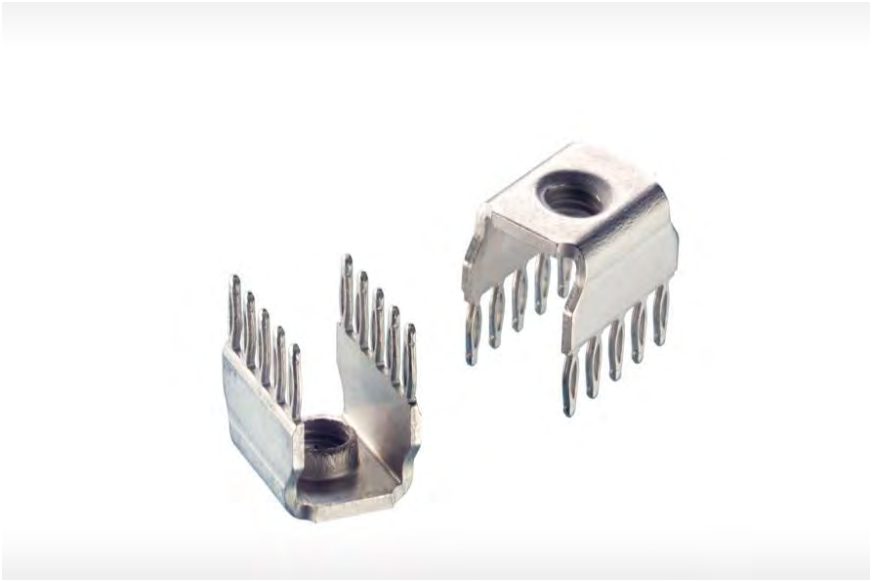
For over 25 years the ERmet 2.0 mm HM connector system has proven itself through its robust design and problem-free handling. ERmet connectors are enjoying broad acceptance globally and enable connections of PCBs in many arrangements. In addition to signal, ERNI's ERmet family includes a power module for another 12A per contact (at 20C).

ERNI's ERmet 2 mm Hard Metric product has been both a product leader in this category but also a quality leader. ERNI offers extensive product variants and unmatched product expertise.

Learn more about ERNI's 2MM Hard Metric, ERmet — Landing Page, Catalog

ERNI for IoT

Product Family Overview of Power Taps



ERNI's Power Taps

Configurations

Key Buying Factors

Current rating up to 40 A

Press-fit or solder PCB terminations

Various metric and English threads sizes

For commercially available lugs

Reliable connection

High flexibility

ERNI Power Taps in a 2.54 mm grid were developed especially for the power supply on the PCB and backplane. They are available in various designs with six or ten connection pins and as dip solder or press fit variants. Depending on the cable connection and PCB, operating currents up to 40 amperes can be realized.

Power Taps have press-fit or solder terminations for fixing to a PCB and can be used with commercially available wire lugs. ERNI quality standards are met to insure a reliable connection.

Learn more about ERNI's Power Taps — Landing Page, Catalog, Flyer