



# Transportation Interconnect Solutions

Connecting Tomorrow's Transportation Infrastructure



# Modes of Transportation

The primary modes of transportation—land, water, and air—are essential to global connectivity, supporting the efficient movement of both people and goods across regions and continents.

Land transportation is the most accessible and versatile mode, accommodating daily commutes, long-distance travel, and freight transport. Roads and highways connect urban centers with rural areas, providing flexible, direct routes that facilitate both personal and commercial mobility. Rail networks further extend land transport capabilities, supporting high-capacity passenger and cargo travel across long distances.

Water transportation is the backbone of international trade and an important mode for passenger travel, particularly via ferries and cruise ships. While generally slower, it is highly cost-effective for moving large volumes over long distances and plays a vital role in connecting remote regions. Ports act as critical hubs, linking water routes with land and air networks to support both tourism and global commerce.

Air transportation delivers unmatched speed, making it the preferred choice for time-sensitive passenger travel and urgent cargo shipments. Airports around the world function as major hubs, providing global connectivity for both people and goods. Though associated with higher costs, air transport is invaluable for industries and travelers requiring rapid connections between distant locations.

Together, these modes form an interconnected system that enables the seamless movement of people and goods, driving economic growth and fostering worldwide access and mobility.

## Air

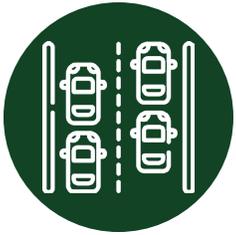


## Land



## Water





**1.475 Billion  
Vehicles**

Using available averages by country, there are an estimated 1.475 billion vehicles, globally, in 2024. <sup>1</sup>



**38.7 Million  
flights annually**

The number of flights performed globally by the airline industry has mostly recovered to 38.7 million flights expected in 2024 from the recent low of 18.3 million flights in 2020. <sup>2</sup>



**Over 80%**

Ships deliver over 80% of world trade. <sup>3</sup>

# APPLICATIONS

## Road

Road transportation includes vehicles such as cars, trucks, buses, and motorcycles, supporting the movement of people and goods on highways, streets, and rural roads. It is highly flexible and accessible, providing essential passenger transit and last-mile delivery, as well as recreational and commercial travel through personal vehicles, buses, and freight trucks.

### Example Applications

Braking and stability control, electric vehicle battery management, engine control units, GPS navigation, infotainment, lighting systems, roadside emergency communication systems, signaling systems, toll collection units



## Rail

Rail transport includes passenger and freight trains that operate on dedicated tracks, efficiently moving large volumes of people and cargo across urban, regional, and national distances. Rail systems offer long-distance and commuter transit for passengers, while freight trains are widely used for heavy or bulk goods transport, like coal and agricultural products.

### Example Applications

Control panels, signaling systems, passenger information displays, HVAC systems, braking systems, onboard communication networks, traffic signaling, automated rail switches, rail monitoring systems, intercoms



## Off-road

Off-road transport includes specialized vehicles like ATVs, dune buggies, tractors, and construction machinery used across sectors such as agriculture, mining, and forestry. These vehicles enable essential transport and mobility in rugged, undeveloped areas, supporting industries that rely on dependable off-road capabilities.

### Example Applications

Automated rail switches, braking systems, control panels, HVAC systems, intercoms, onboard communication networks, passenger information displays, rail monitoring systems, signaling systems, traffic signaling



## Pipeline

Pipelines are essential for transporting large volumes of liquids and gases, such as oil, natural gas, and water, over land and sometimes underwater. They enable a continuous and efficient flow from remote production areas to processing plants, cities, or distribution hubs, serving as a backbone for energy and resource transport.

### Example Applications

Communication links, control station networks, flow and pressure sensors, leak detection systems, pipeline monitoring systems, real-time data transmission, remote operation controls, telemetry equipment, temperature monitoring



# Marine

Marine transport, encompassing cargo ships, tankers, ferries, and cruise ships, supports international trade and passenger travel across oceans and seas. Cargo ships and tankers handle global freight logistics, while ferries and cruise ships provide travel options for passengers, as well as water-based recreational activities, including yachting and boating.



## Example Applications

Cargo management systems, communication systems, engine controls, navigation systems, onboard lighting, power distribution, radar equipment, safety and emergency systems, ship diagnostics and testing equipment, sonar systems

# Inland Waterways

Inland waterway transport uses ships, barges, and small watercraft on rivers, lakes, and canals to move both goods and passengers. Barges transport heavy goods like raw materials within and between locations, while ferries carry people across rivers and lakes. Additionally, recreational watercraft, like kayaks and fishing boats, are popular for leisure activities on inland waterways.



## Example Applications

Communication systems, control panels, dockside communication, emergency lighting, GPS tracking, inland water monitoring systems, motorized winches, navigation systems, power management, safety systems, sensor networks

# Air

Air transport, including commercial airplanes, helicopters, and increasingly, drones, is the fastest mode for moving people and goods over long distances. Commercial airlines transport millions of passengers globally, while cargo planes ship time-sensitive, high-value goods. Helicopters are used for short-distance passenger transit, emergency medical services, and remote access. Drones are emerging as a mode for lightweight cargo delivery and aerial surveying, with potential for expanded roles in logistics and even passenger transport in the future.



## Example Applications

Avionics systems, cabin lighting, cockpit instrumentation, drones for cargo and surveying, emergency lighting systems, GPS and navigation, in-flight entertainment monitors, onboard communication systems, sensor arrays

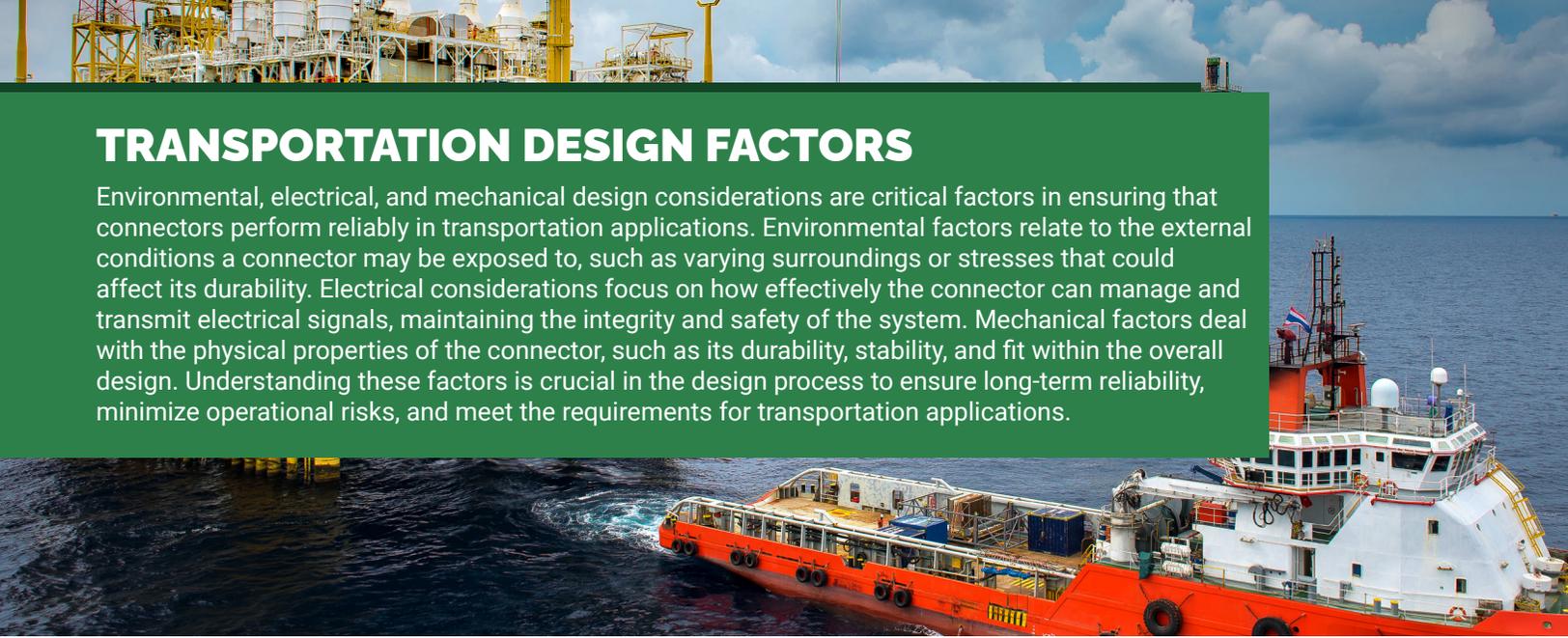
# Space

Space transport is an emerging mode primarily used for launching satellites, scientific research, and exploration, with growing applications in commercial and tourism sectors. Spacecrafts transport satellites for communication, GPS, and earth observation, while space stations and probes support scientific and technological advancements. Commercial space travel and space tourism are beginning to take shape, and cargo missions to support orbital stations are increasingly common. With continued advancements, space transport may further expand to enable interplanetary missions and potentially new modes of commercial travel in the future.



## Example Applications

Data transmission, imaging and observation equipment, onboard life support, power distribution, propulsion control, satellite communication, scientific instrumentation, sensor arrays, spacecraft navigation, thermal control systems



# TRANSPORTATION DESIGN FACTORS

Environmental, electrical, and mechanical design considerations are critical factors in ensuring that connectors perform reliably in transportation applications. Environmental factors relate to the external conditions a connector may be exposed to, such as varying surroundings or stresses that could affect its durability. Electrical considerations focus on how effectively the connector can manage and transmit electrical signals, maintaining the integrity and safety of the system. Mechanical factors deal with the physical properties of the connector, such as its durability, stability, and fit within the overall design. Understanding these factors is crucial in the design process to ensure long-term reliability, minimize operational risks, and meet the requirements for transportation applications.

## ENGINEERING DESIGN CONSIDERATIONS

### Electrical

#### EMI/RFI Exposure

Connectors must be designed to shield against electromagnetic and radio frequency interference, particularly in environments like rail, road, and aviation where multiple electronic systems operate in proximity.

#### Grounding and Bonding

Proper grounding and bonding prevent electrostatic discharge (ESD) and reduce interference, particularly in rail systems and heavy equipment, where high currents and electrical noise can affect nearby components.

#### Power Management

Ensuring stable, consistent power delivery across varied loads, minimizing power loss, and maximizing efficiency through low-resistance connections is critical for high-power systems in electric vehicles, rail, and heavy machinery.

#### Signal Integrity

Maintaining clear, interference-free data transmission is essential in safety-critical systems, including navigation, control, and communication across all transportation modes, as disruptions could impact performance or safety.

#### Surge Protection

Protection against electrical surges and voltage spikes is essential in exposed environments (e.g., roadside equipment, marine navigation systems) that may experience power fluctuations, ensuring connectors maintain consistent and safe operation.

#### Voltage and Current Rating

Connectors must be rated to handle specific voltage and current levels safely, preventing overheating and arcing. High-voltage and high-current applications, like electric vehicles and heavy machinery, rely on correctly rated connectors for optimal performance and safety.



**Engaging with EDAC, an experienced connector manufacturer, early in your design process can help address design considerations for your specific application to mitigate risk.**

## Environmental

### Altitude and Pressure Changes

Connectors in aviation and high-altitude applications must perform under varying air pressures, which can impact insulation and connector integrity.

### Chemical Exposure

Road vehicles and marine applications require connectors resistant to chemicals such as road salts, oils, and de-icing agents, while off-road machinery often encounters agricultural or industrial chemicals.

### Dust, Debris, and Water

Connectors must offer ingress protection to guard against dust, debris, and water, especially in road, off-road, and marine applications that frequently encounter these elements.

### UV Exposure

Prolonged sun exposure in outdoor applications, such as railcars, road vehicles, and pipelines, requires UV-resistant materials to prevent material weakening, fading, and cracking.

### Temperature Extremes

Connectors must withstand a wide temperature range, from freezing to extreme heat, enduring thermal expansion and contraction to ensure consistent performance in demanding environments like rail, aviation, and off-road applications.

## Mechanical

### Installation and Maintenance

Connectors must support quick, secure installation and easy access for regular inspections and repairs, ensuring structural integrity without complex tools or labor-intensive processes, especially in high-density systems like rail and aviation.

### Shock and Vibration

Connectors in transportation face intense shock and vibration, especially in rail, off-road, and aviation. These forces can lead to loosening or wear, making retention features crucial for maintaining reliability in these demanding applications.

### Structural Integrity

Components undergo mechanical stress and fatigue from long-term use, especially in high-load environments like railcars, heavy machinery, and marine vessels, where materials must withstand constant strain without failure.

### Wear and Tear

Repeated movement, friction, and contact with abrasive materials contribute to wear and tear on connectors, especially in off-road, marine, and pipeline applications where debris and physical contact are frequent.

### Weight and Space Constraints

In aviation and specific vehicle designs, connectors must meet strict weight and space limitations to optimize efficiency and minimize bulk, presenting additional mechanical design challenges.



**EDAC is committed to providing long-term product solutions to support extended product life cycles. On discontinued or phased out connectors that are critical to your production, EDAC would be pleased to review your requirements and offer a suitable off-shelf or turnkey solution.**

# V2X (VEHICLES-TO-EVERYTHING)



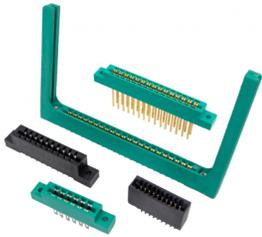
**V2X (Vehicle-to-Everything)** is an advanced communication technology that allows vehicles to interact with other vehicles, infrastructure, networks, and even pedestrians, creating a more connected and safer transportation system. **V2V (Vehicle-to-Vehicle)** communication lets vehicles exchange critical data like speed and location, which helps prevent accidents and improve traffic flow. **V2I (Vehicle-to-Infrastructure)** enables vehicles to communicate with elements like traffic lights and road signs, providing real-time information that optimizes driving routes and reduces delays.

**V2P (Vehicle-to-Pedestrian)** extends safety benefits by allowing vehicles to detect and communicate with pedestrians or cyclists, often through mobile devices, enhancing awareness in busy urban areas. **V2N (Vehicle-to-Network)** connects vehicles to broader networks, enabling them to receive live updates on traffic, weather, and road conditions, making travel more efficient. Additionally, **V2D (Vehicle-to-Device)** allows vehicles to connect directly with personal devices, adding a layer of convenience and security for users.

The benefits of V2X for businesses and communities are substantial, from improved safety and traffic management to enhanced vehicle efficiency and user experience. By enabling smarter interactions between vehicles and their environment, V2X plays a crucial role in the evolution of connected and autonomous mobility, setting the stage for a more responsive and intelligent transportation network.

# INTERCONNECT SOLUTIONS

## Card Edge Connectors



- Card edge connectors available in 446,000+ standard styles, with options for custom variations
- Contact spacing of 0.050", 0.100", 0.125", 0.150", 0.156" and 0.200"
- Selective gold plating on the contact mating area or gold all over with nickel underplating
- From 2 to 144 contacts in single, bridged, and dual rows with or without card support

### Example Applications

Avionics, control panels, GPS navigation, radar and marine navigation equipment, rail control systems, signaling, telematic sensors, vehicle sensors



Reliable Connection



Standard Designs



Durable Construction



High Density Solutions



High Speed Solutions



Customizable

## Rack and Panel Connectors



- Industry standard connector with high-reliability contacts
- Hermaphroditic contact design for no-fail and gas tight connections
- Crimp contacts are available pre-installed, separately in bulk, or on a reel for automated process

### Example Applications

Avionics systems, control modules, test racks, ground support systems, machinery control panels, signaling



Reliable Connection



Durable Construction



EMI/RFI Shielding



Secure Locking



Alignment Features



Customizable

## D-Sub Connectors



- In standard, high-density types and DVI formats with waterproof options available
- 9 to 50 pins (Standard), 15 to 78 pins (High-Density), 29 pins (DVI), and 22 standard contact layouts (Mixed Contact or Power Combo)
- Wide variety of footprints in vertical or right-angle orientations with multiple contact terminations
- Metal backshell options available that provide EMI and RFI protection

### Example Applications

Avionics interfaces, diagnostics, engine control systems, infotainment, marine navigation systems, power transfer, rail communications, signaling



Standard Designs



Durable Construction



EMI/RFI Shielding



High Current Solutions



Waterproof Solutions



Customizable

# INTERCONNECT SOLUTIONS

## Modular & Magnetic Jack Connectors



- RJ11/RJ45 units are available in single or stacked multi-port configurations, with options for LEDs, shielding, and various mounting styles
- Available in right-angle or vertical orientations with through hole or SMT contact termination styles
- Modular jack connectors with integrated network magnetics save space and provide protection against noise, improving signal integrity

### Example Applications

Marine terminal communications, network servers, onboard connectivity, pipeline monitoring, radar systems, rail station networks



Standard Designs



Compact Design



Shielded and Unshielded



Multi-Port Solutions



Integrated Magnetics



Customizable

## USB Connectors



- Up to 480 Mbps communication speed for standard USB 2.0
- Up to 5 Gbps communication speed for standard USB 3.0
- Up to 10 Gbps communication speed for standard USB 3.1
- Receptacle and plug USB 3.1 Type C available in 6, 16, and 24 pin options
- Synchronous and asynchronous data transfer methods
- Waterproof options are available with quarter-turn twist and lock overmold and o-ring

### Example Applications

Data storage, diagnostics tools, handheld controllers, infotainment systems, marine equipment, portable power



Multiple USB Types



Standard Designs



High Speed Solutions



Compact Design



Waterproof Solutions



Customizable

## HDMI Connectors



- Standard 19-pin type A, mini and micro versions are available
- Available in vertical or right-angle orientations and single or dual stacked
- Plating options from gold flash to 30µ" gold for high insertion cycles
- Synchronous and asynchronous data transfer methods
- Waterproof options are available with quarter-turn twist and lock overmold and o-ring

### Example Applications

Control center displays, in-flight entertainment, passenger information displays, simulators



Reliable Connection



Standard Designs



Hi-Def Video and Audio



High Current Solutions



Waterproof Solutions



Customizable

## Inline Connectors



- Non-waterproof inline connectors designed for high-density wire-to-wire and wire-to-board connections
- Contact termination options include PC tail, wire hole, wire wrap, SMT, and crimp
- Waterproof options available with double latch technology for increased retention
- IP52 and IP67 rated options available

### Example Applications

Aircraft instrumentation, marine engine controls, power distribution, signal transmission



Reliable Connection



Durable Construction



Compact Design



Ease of Use



Waterproof Solutions



Customizable

## Header Connectors



- Header pins can be cut to any height and board depth
- Wide variety of plating options
- Vertical, right-angle, or custom bend orientations
- Breakaway design allows for easy separation into smaller units
- PC tail, SMT, IDC, and press-fit contact terminations available
- DIN 41612 connectors provide durable and reliable connections in modular systems

### Example Applications

Avionics, control boards, distributed system networks, marine data processing, pipeline monitoring, power modules, rail signaling



Reliable Connection



Standard Designs



Durable Construction



Compact Design



Shrouded Solutions



Customizable

## Magnetic Pogo Pin Connectors



- To develop truly versatile quick-release connectors, manufacturers need to look beyond conventional pin and socket designs
- The new range of magnetic pogo pin connectors are designed specifically for quick-release applications
- These connectors provide the same quick-disconnect functionality for up to 31 positions
- Premade cable assemblies available with multiple alternate terminating ends including USB, inline, and bare cable

### Example Applications

Battery charging, diagnostics, test equipment, portable communication, quick-connect systems, remote data logging



Reliable Connection



Compact Design



Self-Cleaning Contacts



Magnetically Polarized



Quick-Release



Customizable

# TRANSPORTATION CASE STUDIES

Electric vehicle technology is rapidly advancing, making charging more accessible and driving efforts toward standardization, which simplifies infrastructure and enhances compatibility across charging networks.



## EV Charging Plug

### Challenge

Designing a 250 kW EV charger handle with a large, heavy 4 AWG cable required an ergonomic, user-friendly design with effective strain relief. Without proper support, the cable's weight risked not only damaging the cable but also causing structural breakage to the handle and charger itself over time.

### Solution

An ergonomic handle was crafted using lightweight, durable materials to enhance grip and reduce strain. Integrated strain relief was strategically designed to counter the cable's weight, preventing both cable stress and potential breakage to the handle, ensuring durability and ease of use for high-power charging.



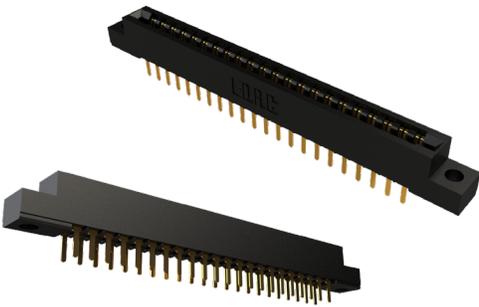
## Traffic Signaling

### Challenge

Traffic signaling equipment required a highly durable card edge connector to reliably transmit signal and power between a daughterboard and motherboard. The connector needed to endure continuous operation and provide stable, long-term performance for safe traffic management.

### Solution

EDAC's reliable card edge connector met the durability and performance standards, ensuring consistent signal and power transmission essential for traffic signaling. This solution enabled dependable, long-lasting functionality.



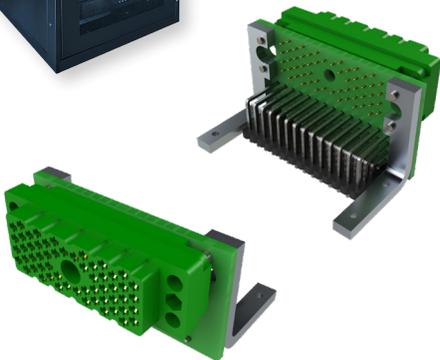
## Automotive Test Racks

### Challenge

Automotive validation testing required reliable, high-density connections in a test rack to support various devices under test (DUT). Traditional wiring was costly, labor-intensive, and prone to errors, making setup inefficient.

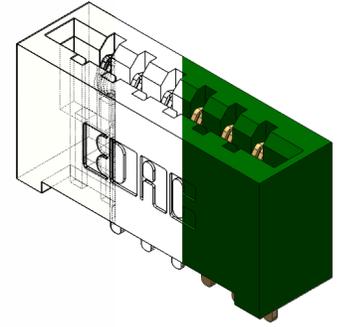
### Solution

Implemented a right-angle rack and panel connector with an integrated PCB, eliminating manual wiring. This solution significantly reduced setup time, minimized errors, and provided consistent reliability for efficient DUT testing, suitable for use in environmental chambers and other validation setups.



**Designing custom interconnect solutions minimizes risk to your project and increases success, especially in industries with regulatory compliance requirements.**

**Custom solutions from concept to production in as little as 12 weeks**



## Why EDAC?

EDAC is a global leader in connector manufacturing, recognized for its innovative solutions and expertise since 1966. With a head office and design engineering center in Canada, EDAC offers a comprehensive range of interconnect products. We specialize in delivering tailored solutions to global customers, serving OEMs, ODMs, CMs, and distributors through an extensive network of fulfillment centers and highly skilled engineering and quality assurance teams. EDAC's commitment to total quality and seamless delivery ensures that our products meet the highest standards while consistently exceeding customer expectations.

At EDAC, our strength lies in collaboration and adaptability. We can offer custom solutions and value-added solutions, like wire harnesses and cable assemblies, with the flexibility to produce low and high-volume orders to customer specifications. With a robust, global team of engineers and program managers, we provide cost-effective, on-time solutions from prototype to production. Our dedication to integrity, innovation, and quality drives long-term partnerships and supports customer success in fast-evolving industries.

## Certifications

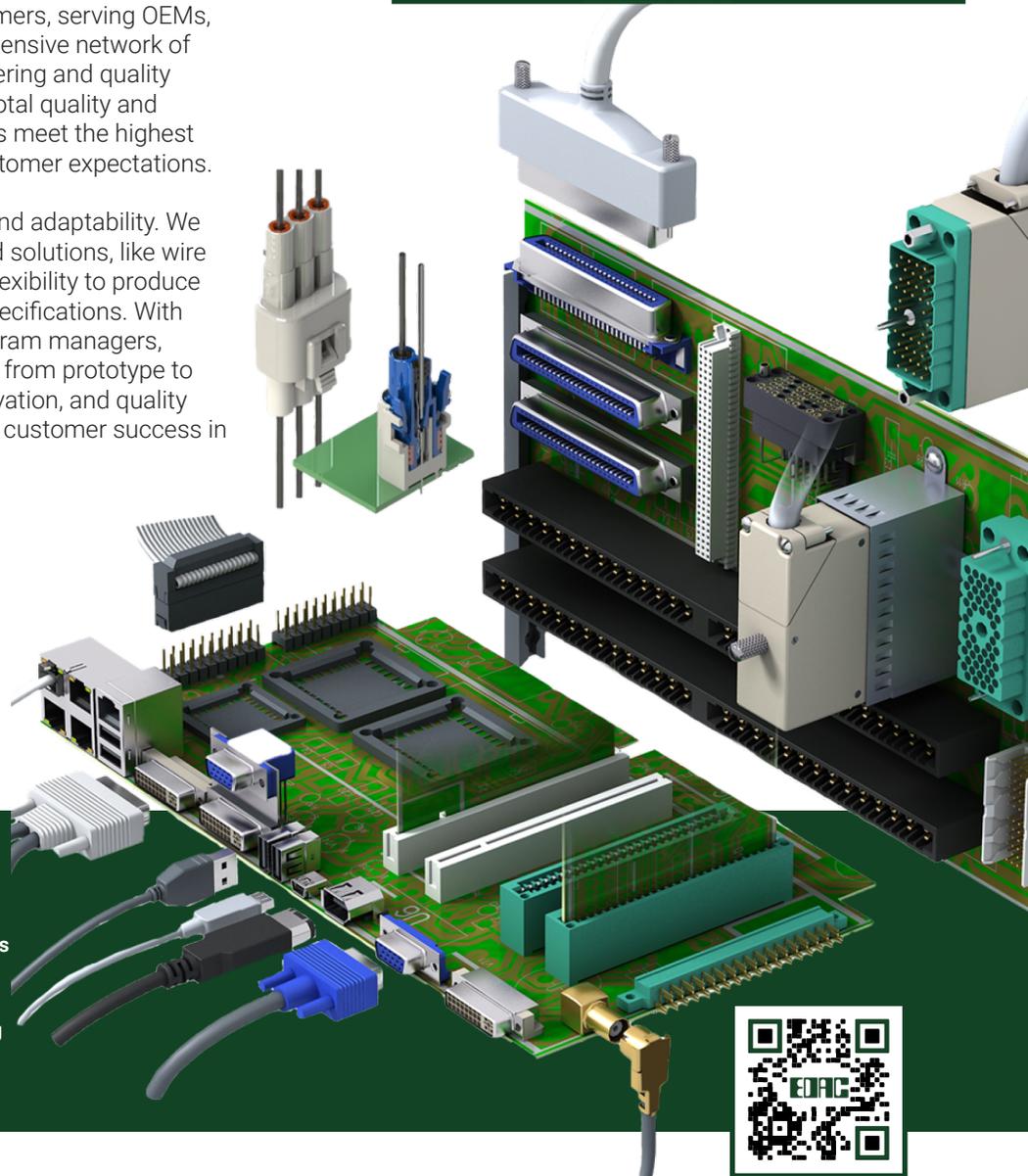


**ECIA MEMBER**  
Supporting The Authorized Channel

**ecovadis**

## Our Capabilities

- Manufacturing Excellence
- Exceptional Service
- Global Shipping
- Engineering Expertise
- Innovative Solutions
- Customized Designs
- Rapid Prototyping
- Quality Assurance
- Competitive Pricing



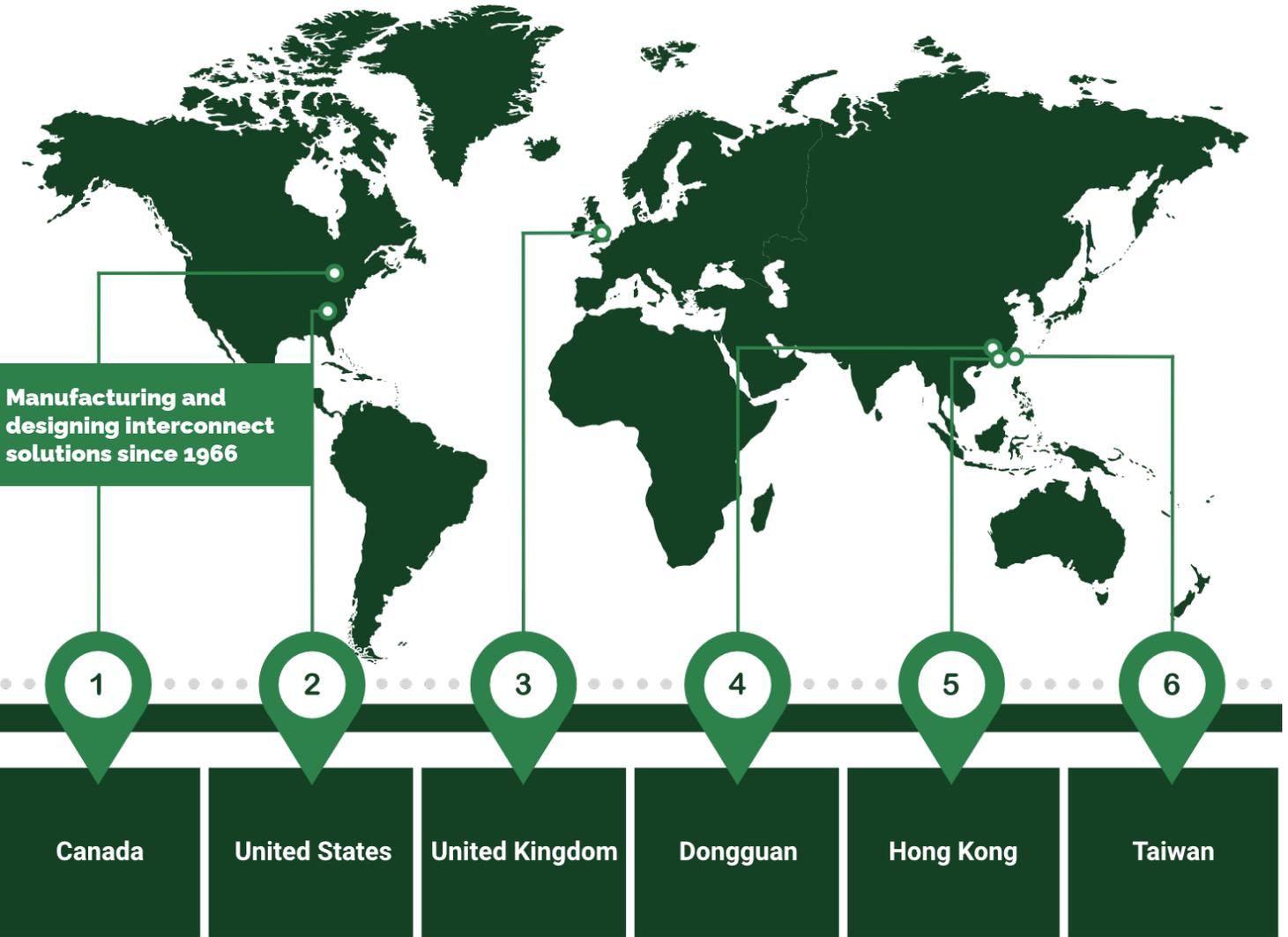
Product Catalog

**EDAC's global presence and manufacturing excellence deliver cost-effective interconnect solutions, designed with the customer in mind, enabling seamless project execution and ensuring success through dedicated engineering teams and worldwide support.**



**Markets Served**

Consumer	Medical	Ruggedized
Agriculture	Energy	Process Control
Transportation	Industrial	Robotics



<sup>1</sup> Admin. (2024, February 2). How many cars are there in the world? statistics by country. Hedges & Company. <https://hedgescompany.com/blog/2021/06/how-many-cars-are-there-in-the-world/>

<sup>2</sup> Airline industry worldwide - number of flights 2024. Statista. (2024a, May 11). <https://www.statista.com/statistics/564769/airline-industry-number-of-flights/>

<sup>3</sup> Gynspan, R. (2022). Review of Maritime Transport 2022. UNCTAD. <https://unctad.org/rmt2022>

**EDAC**

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Experience Makes The Difference**



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