Energy Interconnect Solutions

Empowering Sustainable Energy Systems

www.EDAC.net

New policies, geopolitical events, and technology breakthroughs will continue to shift the trajectory of the global energy system.

Energy Consumption

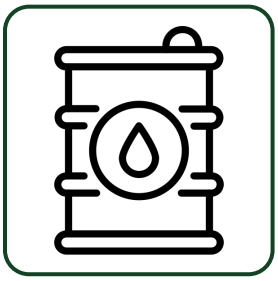
Energy consumption will continue to increase with demand expected to grow the fastest in industrial and residential sectors. [1]

+76% Electricity Generation

Total electricity generation worldwide expected to increase to 76% by 2050 (from 36% in 2022). [2]

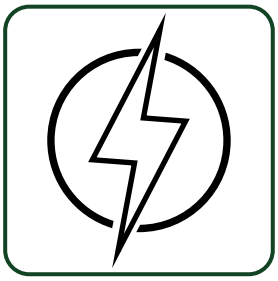
Zero-Carbon Technologies

Countries are accelerating local energy infrastructure development, driving increased investments in zero-carbon technologies. [3]



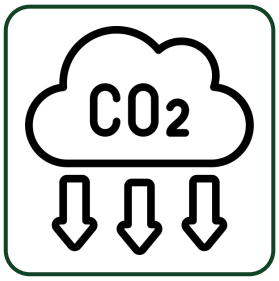
Fossil Fuels

- Oils
- Natural Gas
- Coal
- Methane Abatement
- Gas Flaring



Electricity

- Electrification
- Nuclear Power
- Grid-scale Storage
- Smart Grids



Low-Emission Fuels

- Electrolyzers
- Hydrogen
- Biofuels

Renewables

- Solar
- Hydro
- Wind
- Geothermal
- Bioenergy

The energy landscape is transitioning rapidly, with a blend of traditional and innovative sources shaping the future of power generation and consumption. Fossil fuels such as coal, natural gas, and oil, continue to provide a substantial portion of global energy but face increasing pressure due to environmental concerns like methane emissions and gas flaring. Efforts to reduce these emissions, such as methane abatement technologies, are becoming crucial as industries strive to balance energy demand with sustainability.

The rise of electricity as a dominant energy carrier is accelerating the push toward electrification, supported by nuclear power, grid-scale energy storage solutions, and the development of smart grids to improve efficiency and reliability. In parallel, low-emission fuels - including hydrogen and biofuels - are gaining traction as cleaner alternatives to fossil fuels, providing a pathway to decarbonize sectors like transportation and heavy industry.

Renewable energy sources, including solar, wind, hydro, geothermal, and bioenergy, are growing rapidly and reshaping the energy market. These renewables offer sustainable and scalable solutions, contributing to global efforts to reduce carbon emissions while supporting long-term energy security. As businesses look toward the future, diversification across these energy types will be key to meeting both environmental and economic goals.

The energy value chain represents the full cycle of how energy — whether from fossil fuels, electricity, low-emission fuels, or renewables — is produced, transmitted, distributed, consumed, stored, and monitored. This holistic approach includes applications across traditional and emerging energy sources, ensuring reliable delivery and usage for various sectors.

APPLICATIONS

Generation

Power and fuel generation form the first step in the energy value chain. Energy is produced from a wide range of sources, including fossil fuels (coal, oil, natural gas), renewable sources (solar, wind, hydro, geothermal), and low-emission fuels (hydrogen, biofuels). These energy sources are converted into usable forms like electricity, heat, or fuel.

Example Applications

Oil refineries, coal power plants, natural gas turbines, solar farms, wind farms, hydroelectric dams, geothermal power plants, hydrogen production facilities (electrolyzers), biofuel plants, solar photovoltaic systems, wind turbines, biomass energy plants

Transmission

Transmission focuses on transporting energy from generation sites to distribution hubs or storage facilities. For electricity, this involves high-voltage lines carrying power over long distances. For fossil fuels and low-emission fuels, it includes pipelines and transportation networks delivering oil, natural gas, or hydrogen to refineries or storage.

Example Applications

Oil and gas pipelines, crude oil transport systems, LNG (liquefied natural gas) pipelines, high-voltage systems, subsea power systems, smart grid transmission, hydrogen pipelines, biofuel transportation networks, transmission from offshore wind farms, solar farm transmission networks

Distribution

Distribution involves delivering energy—whether electricity or fuel—to end-users such as homes, businesses, and industries. For electricity, this includes the use of local grids and transformers that reduce high-voltage power for safe consumption. For fossil and low-emission fuels, distribution relies on gas and fuel networks that connect sources to end points like gas stations, ensuring accessible energy across various sectors.

Example Applications

Gas distribution networks, gas stations, fuel delivery systems, heating oil distribution, local power grids, electrical substations, transformers, EV charging stations, smart meters, microgrids, hydrogen refueling stations, biofuel distribution systems, rooftop solar distribution systems

Consumption

Consumption refers to the use of energy by various end-users, including residential, commercial, and industrial sectors. It also covers the transportation sector, where fossil fuels, electricity, and low-emission fuels power vehicles and heavy equipment. Consumers require energy for daily functions, including running appliances, powering industrial machinery, and fueling transportation.

Example Applications

Gasoline and diesel vehicles, industrial machinery, natural gas heating, gas pumps, residential and commercial buildings, electric vehicles (EVs), data centers (hyperscalers), hospitals, public transportation, wind-powered systems

Storage

Energy storage systems are vital for balancing supply and demand across all energy types, ensuring grid stability and backup power when needed. Storage technologies store electricity, fuels, or heat for future use, especially during peak demand or energy shortages.

Example Applications

Natural gas storage facilities, LNG (liquefied natural gas) storage tanks, oil storage depots, grid-scale battery storage, home battery storage systems, pumped hydroelectric storage, compressed air storage, hydrogen storage systems, biofuel storage tanks, energy storage for solar and wind power systems, flywheel energy storage for renewable integration

Monitoring

Monitoring and maintenance use advanced technologies like sensors, smart meters, and digital platforms to track energy system performance, detect inefficiencies, and prevent failures. Real-time data and automated solutions, such as drones, AI, and IoT, optimize performance and enhance safety, especially in hard-to-reach or hazardous areas like offshore rigs and wind farms.

Example Applications

Smart meters, drones, thermal sensor equipment, pipeline network sensors, remote monitoring technologies, cameras, vibration sensors, control units, IoT-enabled sensors, satellite-based monitoring

ENERGY DESIGN FACTORS

Environmental, electrical, and mechanical design considerations are critical factors in ensuring that connectors perform reliably in energy 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 energy applications.

ENGINEERING DESIGN CONSIDERATIONS

Electrical

EMI/RFI Exposure

EMI-shielded connectors protect signal integrity in environments with high electromagnetic and radio frequency interference, ensuring uninterrupted communication in energy control systems.

Grounding and Bonding

Connectors that support proper grounding and bonding help maintain electrical stability and prevent hazardous conditions, ensuring safe operation in energy environments.

Power Loss and Efficiency

Efficient connectors reduce power losses during energy transmission and conversion, optimizing overall system performance and minimizing energy waste.

Signal Integrity

High-performance connectors preserve signal clarity and accuracy in data transmission, especially in environments with heavy electromagnetic interference, like power plants and substations.

Surge Protection

Connectors designed for surge protection safeguard infrastructure by channeling excess energy during electrical surges, preventing damage to critical systems.

Voltage and Current Rating

Connectors must be rated to handle high voltages and currents in energy systems, ensuring safe and reliable operation under demanding electrical loads.

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

Connectors used in high-altitude installations are engineered to perform reliably under lower pressure and reduced cooling conditions, ensuring efficient operation.

Chemical Exposure

Connectors need to resist degradation or corrosion when exposed to oils, solvents, and gases in industrial, oil, and gas applications.

Dust, Debris, and Water

Connectors with appropriate IP ratings protect against the ingress of dust, debris, and water, ensuring continuous operation in harsh outdoor conditions such as wind farms or hydroelectric plants.

Temperature Extremes

Components capable of withstanding extreme temperatures ensure reliable performance in harsh conditions, from the heat of desert solar farms to the cold of offshore wind turbines.

UV Protection

UV-resistant materials protect connectors from prolonged exposure to sunlight, preventing degradation and extending the lifespan of outdoor energy infrastructure.

Mechanical

Installation

Connectors designed for secure installation include features like locking mechanisms and strain relief to ensure reliable, stress-free connections. They offer flexibility in mounting and routing, making them ideal for various environments, from offshore platforms to wind farms, while maintaining organized and robust connections.

Shock and Impact

Connectors designed to withstand shock and impact are essential for energy infrastructure systems facing physical stress, such as power generation, distribution networks, and renewable energy installations exposed to harsh conditions.

Space Constraints

Compact connectors are designed to fit within tight spaces in energy systems, optimizing performance without sacrificing reliability.

Vibration

Vibration-resistant connectors maintain their integrity under constant mechanical stress, preventing disconnections or wear in applications like wind turbines.

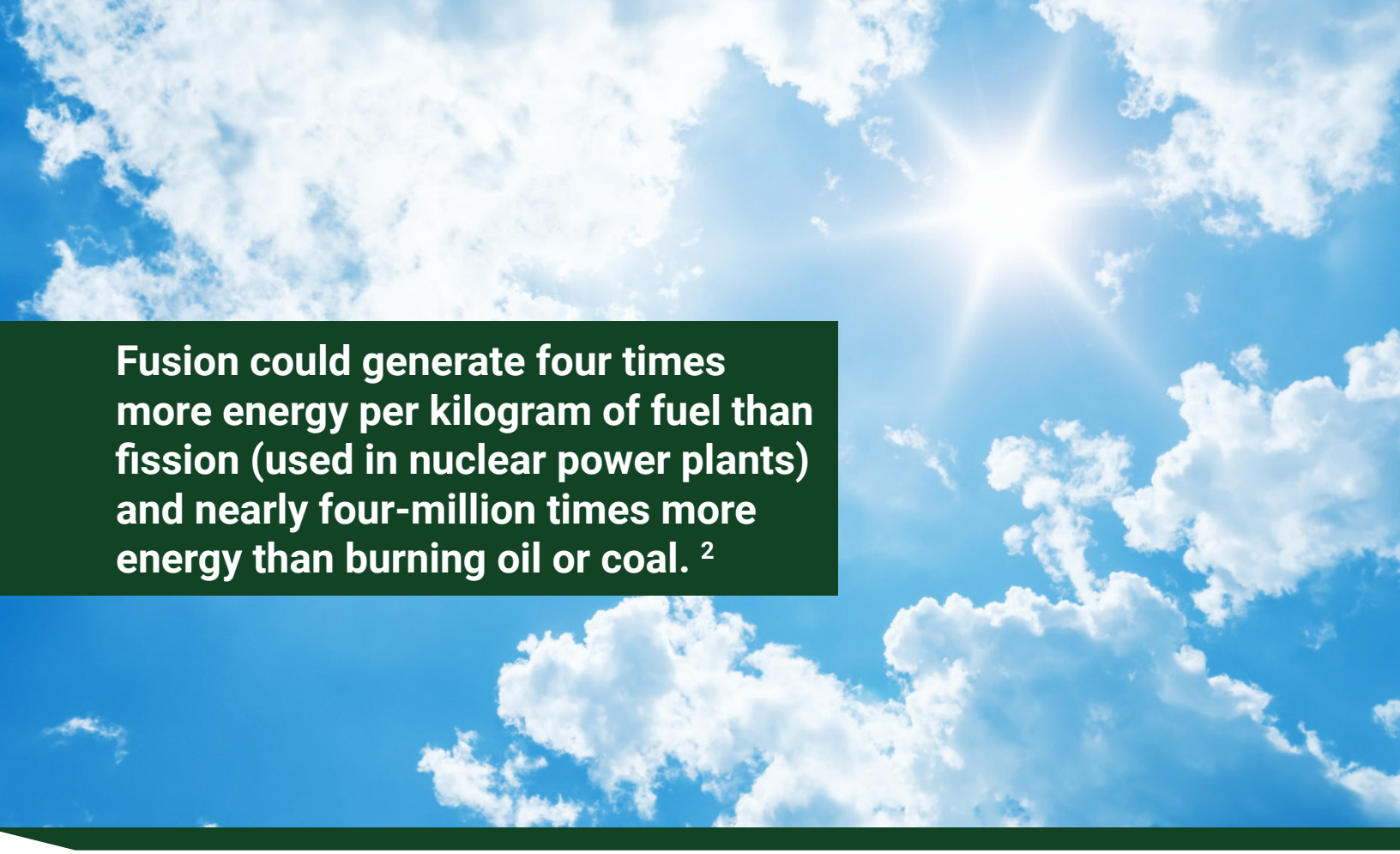
Wear and Tear

Connectors designed for heavy-duty applications resist wear and tear, ensuring longevity in energy systems that operate continuously, such as pipelines and power plants.

Weight Limitations

Lightweight connectors reduce strain on offshore turbines or aerial systems, enabling easier installation and operation without compromising durability or performance.

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.



Fusion could generate four times more energy per kilogram of fuel than fission (used in nuclear power plants) and nearly four-million times more energy than burning oil or coal. [2]

NUCLEAR FUSION: THE ENERGY OF TOMORROW

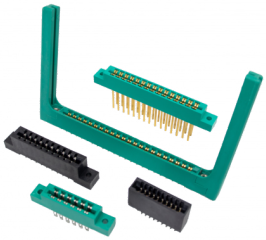
Nuclear fusion, the same process that powers the sun, holds the promise of a cleaner, more sustainable future for energy. Unlike current nuclear power, which splits atoms apart, fusion works by combining light atoms, like hydrogen, to release enormous amounts of energy. This process could generate almost limitless power, with very little environmental impact, offering an alternative to fossil fuels and traditional nuclear power.

What makes nuclear fusion especially appealing is its potential to produce energy without harmful emissions or long-lasting radioactive waste. The fuels needed for fusion are abundant, and the process itself is much safer compared to nuclear fission. If successful, fusion could meet the world's growing energy demands while drastically reducing the environmental footprint of energy production.

Although we are still in the early stages of making fusion a reality, many global projects are pushing the boundaries of what's possible. Research initiatives are aiming to make nuclear fusion a viable energy source in the coming decades. If achieved, fusion could revolutionize the energy industry, providing clean, affordable, and nearly unlimited power for future generations.

INTERCONNECT SOLUTIONS

Card Edge Connectors



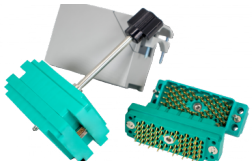
- Card edge connectors available in 446,000+ standard styles, with options for custom variations
- Contact spacing of 0.050”, 0.100”, 0.125”, 0.150”, 0.156” and 0.200”
- Selective gold plating on the contact mating area or gold all over with nickel underplating
- From 2 to 144 contacts in single, bridged,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

Example Applications

Battery management systems, control panels, control units, EV chargers, grid-scale storage, home battery systems

Reliable Connection | Standard Designs | Durable Construction
High Density Solutions | High Speed Solutions | Customizable

Rack and Panel Connectors



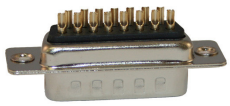
- Industry standard connector with high-reliability contacts
- Hermaphroditic contact design for no-fail and gas tight connections
- Crimp contacts are available pre-installed, separately in bulk, or on a reel for automated process

Example Applications

Control systems, grid battery systems, large-scale storage systems, test equipment

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

Control panels, control units, EVs, grid-scale storage, home battery systems, monitoring equipment, substations

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

Communication and control systems, EV charging, HVAC systems, remote monitoring devices, smart home devices, smart meters

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

Control systems, EV charging, smart appliances

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

Data centers, monitors

Reliable Connection | Standard Designs | Hi-Def Video and Audio
High Current Solutions | Waterproof Solutions | Customizable

Inline Connectors

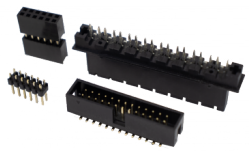
- Non-waterproof inline connectors designed for high-density wire-to-wire and wire-to-board connections
- Contact termination options include PC tail, wire hole, wire wrap, SMT, and crimp
- Waterproof options available with double latch technology for increased retention
- IP52 and IP67 rated options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

Example Applications

Battery management systems, communication equipment, diagnostic tools, drones, distribution systems, energy storage systems

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

Battery management systems, control units, EV chargers, HVAC systems, inverters, remote monitoring devices, smart grid and meters

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

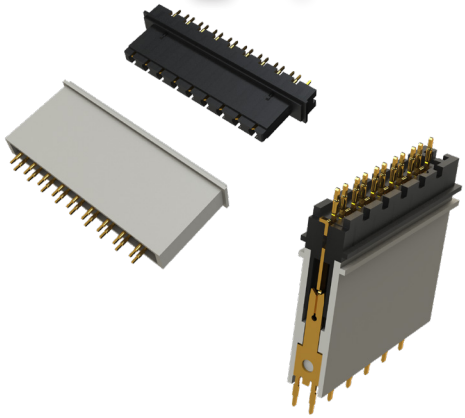
Drones, monitoring tools, portable maintenance devices, smart meters, test equipment

Reliable Connection | Compact Design | Self-Cleaning Contacts
Magnetically Polarized | Quick-Release | Customizable

ENERGY CASE STUDIES

Wind turbines are expected to more than double by 2028 compared with 2022. [3]

Wind Turbine Control Unit

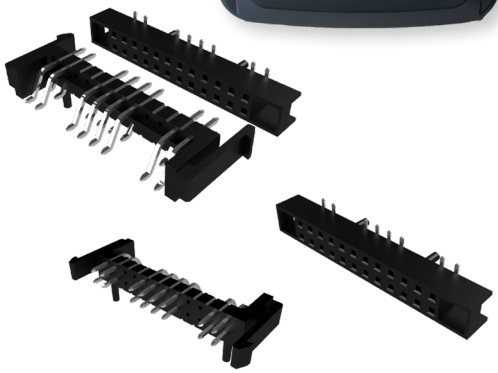


Challenge

A wind turbine's nacelle required a highly durable, vibration-resistant connector with an alignment feature for easy installation in the control unit.

Solution

EDAC designed custom press-fit connectors with heavy gold plating for durability, a pre-alignment feature for reliable installation, and Press-Fit tails to reduce assembly time. The hermaphroditic "tuning fork" contact ensures a reliable 4-point connection, ideal for onshore and offshore environments.



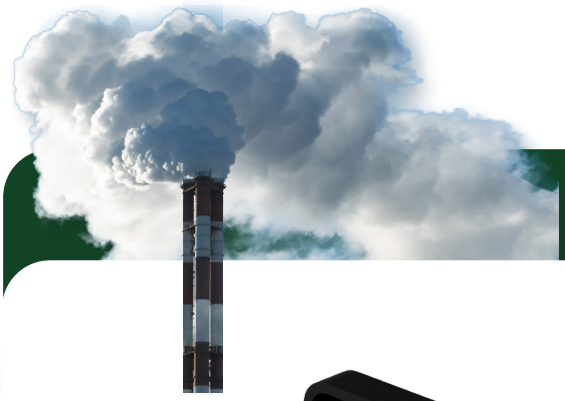
Renewable Energy Inverter

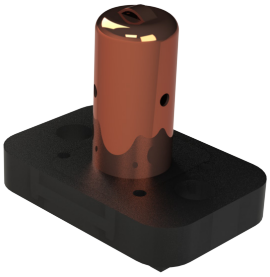
Challenge

A renewable energy inverter needed a lightweight, reliable connector solution that could handle electrical surges while maintaining durability.

Solution

EDAC developed a compact custom header with careful material selection for latch durability and contact design tailored to manage surge requirements, ensuring long-term reliability in renewable energy systems.





Boiler Flue Gas Sensor

Challenge

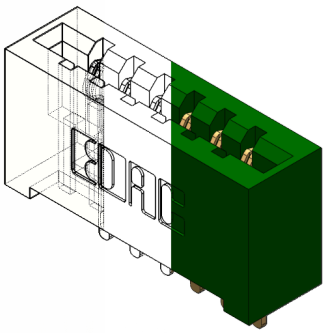
A sensor used in boiler flue gas applications required a connector that could withstand harsh environmental conditions and heavy use.

Solution

EDAC designed a connector with high-temperature resistant materials, spring contacts for consistent engagement, and orientation tabs for reliable mating. The interface seal prevents interference with sensor operations, and gold-plated contacts ensure long-term reliability, providing a robust solution for gas flue monitoring.

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.

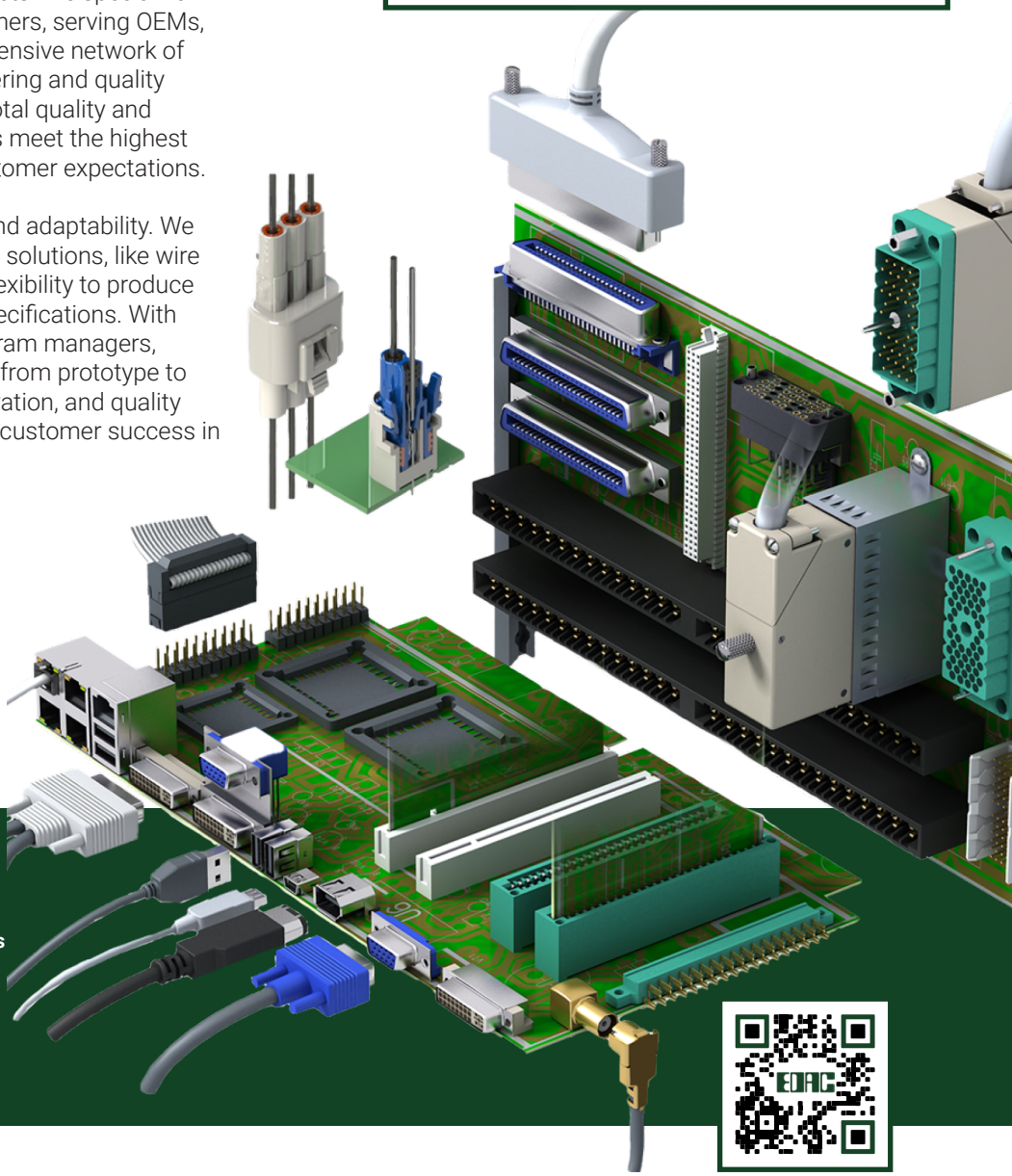
At EDAC, our strength lies in collaboration and adaptability. We can offer custom solutions and value-added solutions, like wire harnesses and cable assemblies, with the flexibility to produce low and high-volume orders to customer specifications. With a robust, global team of engineers and program managers, 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

ISO 9001:2015 · ISO 14001:2015 · IATF 16949:2016 · RoHS

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

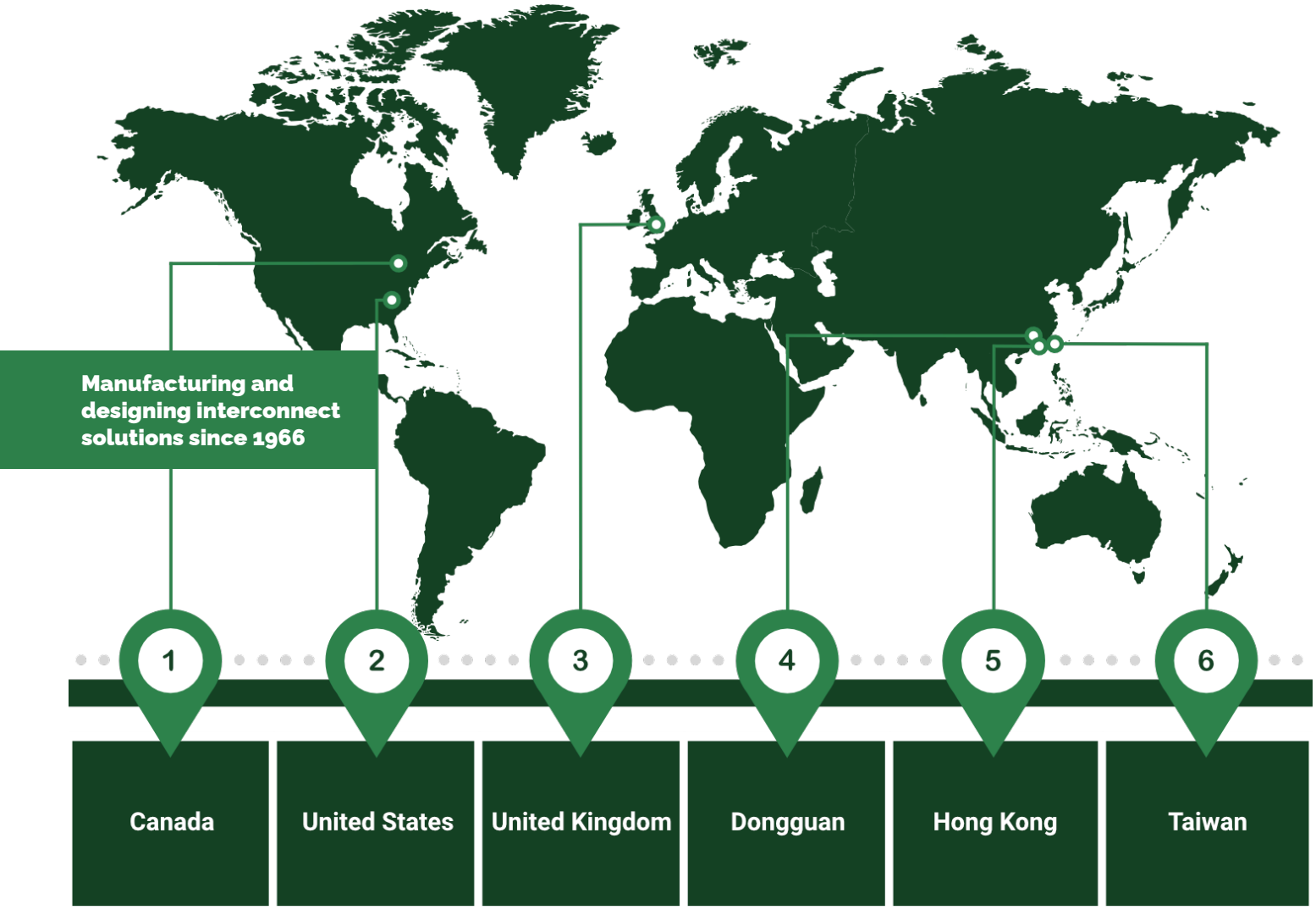
Product Catalog

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.

EDAC GROUP OF COMPANIES
EDAC
58+ YEARS
EST. 1966
INTERCONNECT SOLUTIONS

Markets Served

- Consumer
- Medical
- Ruggedized
- Agriculture
- Energy
- Process Control
- Transportation
- Communications
- Industrial
- Robotics



[1] International Energy Outlook 2023 - U.S. Energy Information Administration (EIA). (n.d.). https://www.eia.gov/outlooks/ieo/

[2] Barbarino, M. (2023, August 3). What is nuclear fusion?. IAEA. https://www.iaea.org/newscenter/news/what-is-nuclear-fusion

[3] Iea. (n.d.). Wind. IEA. https://www.iea.org/energy-system/renewables/wind


EDAC
Connect With Us. . .
Experience Makes The Difference
www.EDAC.net