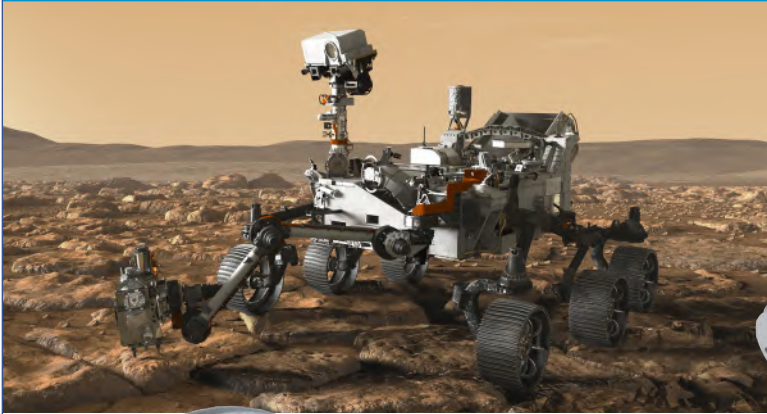


Motion Control Devices



Over 70 Years of Reliable Motion Control Devices

Ducommun Incorporated is the premier supplier of highly reliable precision motors, resolvers and actuators. Ducommun's product line consists of hundreds of custom designed electromechanical components for operations in extreme environments from deep space to miles underground.

Motion Control Device Heritage

Our technological heritage dates back to 1948 and our products range from use in down hole oil exploration tools and military applications to satellites, space vehicles, and launch vehicles. Latest space programs include: CASSINI, COWVR, Dream Chaser, Rosetta, Venus Express, GOME, Hubble Rescue, INMARSAT, ISS, Mars Rovers (Pathfinder, Spirit, Opportunity & 2020), LANDSAT, Dextre Robot, Mexsat, MILSTAR, SMAP, MAIA, Sentinel 6, Space Shuttle, SWOT & Teal Ruby.

Markets

- Space exploration vehicles
- Satellites
- Launch vehicles
- Oil & gas exploration
- Downhole drilling
- Submarines
- Commercial & military aerospace
- Ground vehicles
- Custom solutions

Space

Space qualified stepper motors, BLDC motors and resolvers for satellites and space exploration vehicles are a core competency of Ducommun. With more than 70 years of proven heritage, Ducommun has become a leading supplier of highly reliable integrated solutions. We supplied the actuators for the Rover Stand-up Operation on the NASA Mars Exploration Rover and Brushless DC motors for the Mars Pathfinder program. Forty-two (42) resolvers were also placed on the International Space Station. Latest programs include resolvers for NASA's Frontiers Mission to Jupiter and Stepper motors with gear head for the MARS 2020 program.



Ducommun has provided stepper motors for Tracking and Data Relay Satellites (TDRS) since the early 1990's

Oil and Gas Exploration

Ducommun has more than 70 years of experience in design and manufacturing of highly reliable motors and alternators for down hole oil exploration tools. The motors are used many miles beneath the earth's surface at extreme temperatures of up to + 250°C and high pressures of up to 30,000 psi. Our latest development of high efficiency motors provide additional reliability for the increasing demanding down hole drilling environment. Down hole motor success frequently requires units with exceptionally long, thin aspect ratios, i.e.: 1.5" dia x 9" long.



For over 30 years, Ducommun has supported Fortune 500 oil exploration companies with highly reliable downhole motors.

Military

Ducommun's highly specialized Stepper and DC electric motors, position sensors (resolvers), and electromechanical actuators are found in antennas, waveguide systems, gimbals for azimuth and elevation positioning. Ducommun continues to lead the industry as a manufacturer of high quality, reliable products that have proven successful in demanding applications for commercial and military aircraft, sub-marines, ground defense and weapon systems.



In 1976, we expanded into the military markets and provided the US Trident with durable resolvers for precision gimbal applications

PRODUCTS



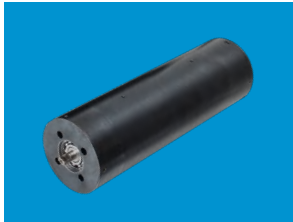
Stepper Motor

- Permanent magnet
- Hybrid
- Variable Reluctance (VR)
- 2, 3, and 4 phase
- Optional with gear head



DC-Motor

- Brushless Motors (BLDC)
- Torquers
- Alternators
- Optional with gear head, feedback, and/or brake



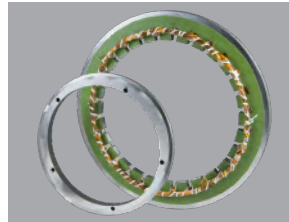
AC-Motors

- Oil exploration motors for High Temp. (250°C)
- High efficiency
- Optional with gear head
- Single and 3 Phase



Resolvers

- High accuracy up to +/- 5 arc-sec
- Pancake or housed
- Single, multi & dual Speed
- Brushless (rotary transformer)



Variable Reluctance Resolvers (Brushless)

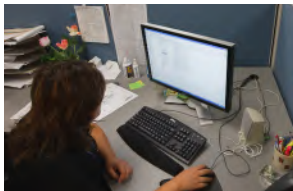
- Accuracy up to +/- 2 arc-min
- Compact design, lightweight
- No rotary transformer required



Actuators/Subassemblies

- AC/DC
- Rotary/linear
- With gear head, lead, screw, etc.
- Permanent magnet multi-position

CAPABILITIES



Engineering

- 70 years of experience in design & manufacturing
- New product development
- Mechanical and electromagnetic analysis



Quality

- ISO 9001 / AS9100 Cert
- Clean rooms class ISO 7+8, Flow benches ISO 5
- Continuous improvement Six/Sigma



Environmental Test

- Thermal cycle / shock
- Thermal vacuum
- Random & sine vibration
- Pyroshock
- ESS



Testing

- High accuracy testing
- Dynamometer
- Customer approved acceptance tests



Assembly

- Skilled personnel for component and system assemblies
- J-STD-001 Space Addendum soldering



Manufacturing

- Complete in-house machining capabilities
- Fast prototyping
- Material and component traceability

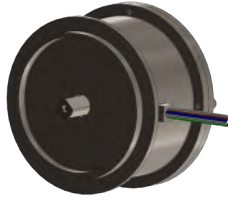


Program Management

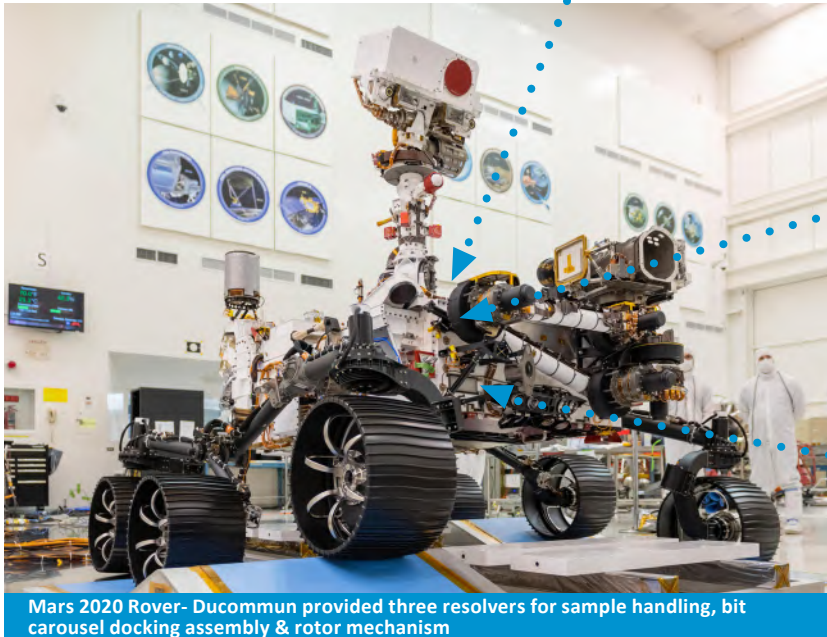
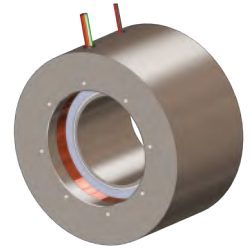
- Customer interface
- Program success
- Performance driven

Critical parts for critical missions...

Bit carousel docking assembly resolver
 Used to return the drill bits back into the bit carousel. The drilling is done by the robotic arm.



Bit carousel rotor mechanism resolver
 Used to measure the angle of rotation of the bit carousel. The carousel holds all the drill bit tools for drilling the core samples.



Mars 2020 Rover- Ducommun provided three resolvers for sample handling, bit carousel docking assembly & rotor mechanism

Sample handling assembly resolver
 Used to transfer the Mars surface core samples.



About Ducommun

Ducommun Incorporated is a leading engineering and manufacturing company that supplies complex electronics, structural solutions, engineered products and aftermarket services to the global aerospace and defense industry.

Founded in 1849, Ducommun is recognized as the oldest business in California. Today, the Company supports a wide range of commercial, military and space platforms including the Boeing 737 NG and 777 airliners, the C-17 heavy lift cargo jet, the Apache, Chinook and Black Hawk helicopters, the Space Shuttle, International Space Station and Mars Rovers.

For decades, Ducommun has designed and manufactured complex electronic systems and sub-assemblies for leading missile programs and platforms, as well as engineering and program management services to the United States Military, the United States Department of Homeland Security, NASA and other government agencies.



Ducommun's approximately 2,700 employees work at its 17 manufacturing centers located in California, Arkansas, Arizona, Kansas, Oklahoma, Missouri, New York, Wisconsin, Thailand and Mexico. Its corporate headquarters is based in Santa Ana, California.



Ducommun Incorporated

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