

Solutions for test stands

Fully engineered, high performance and energy efficient control systems
for automotive, aircraft and generic test equipment

Emerson Industrial Automation

providing reliable
and high quality test
stand solutions for our
customers

Emerson Industrial Automation can provide the products, solutions and services to meet a wide range of test stand applications across many industries. Based on long-term industrial expertise, our application teams can support you in your type and sample tests on finished products, where our testing equipment has been proven many times over providing highly accurate, realistic and reliable results. With several hundred testing facilities already installed, the international automotive industry, its suppliers and the manufacturing industry rely on our experience and flexibility in the field of electric drive technology.

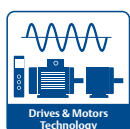
Our test stand solutions are found wherever the emphasis is on accuracy, dynamism and maximum availability which are key drivers in most industries. Typical applications include:

- Testing equipment on development and production lines
- Drive shaft test stands for motor vehicles and heavy goods vehicles/trucks
- Onboard power system test stands for aircrafts or helicopters, including AC generators, hydraulics, fuel pumps, driving and loading turbines
- Test stands for military requirements, such as regulators of aircraft carburetor gear boxes for tanks
- Special test stands, such as testing balance, noise and resonance
- Test stands for electric tools, such as power screwdrivers and saws
- Test stands for electric components, such as voltage and frequency variable testing of chokes and other inductors

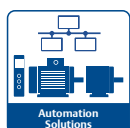


Emerson Industrial Automation's global solutions and services

With many test stand applications in existence across a wide range of industries, our global organisation provides:



Cutting edge drives and motors technology – Our market leading products provide the performance and functionality needed to produce effective control solutions for a wide variety of test stand applications



Scalable Automation Solutions – from small retrofit projects to full electrical test stand solutions, backed by our highly experienced and qualified global application teams

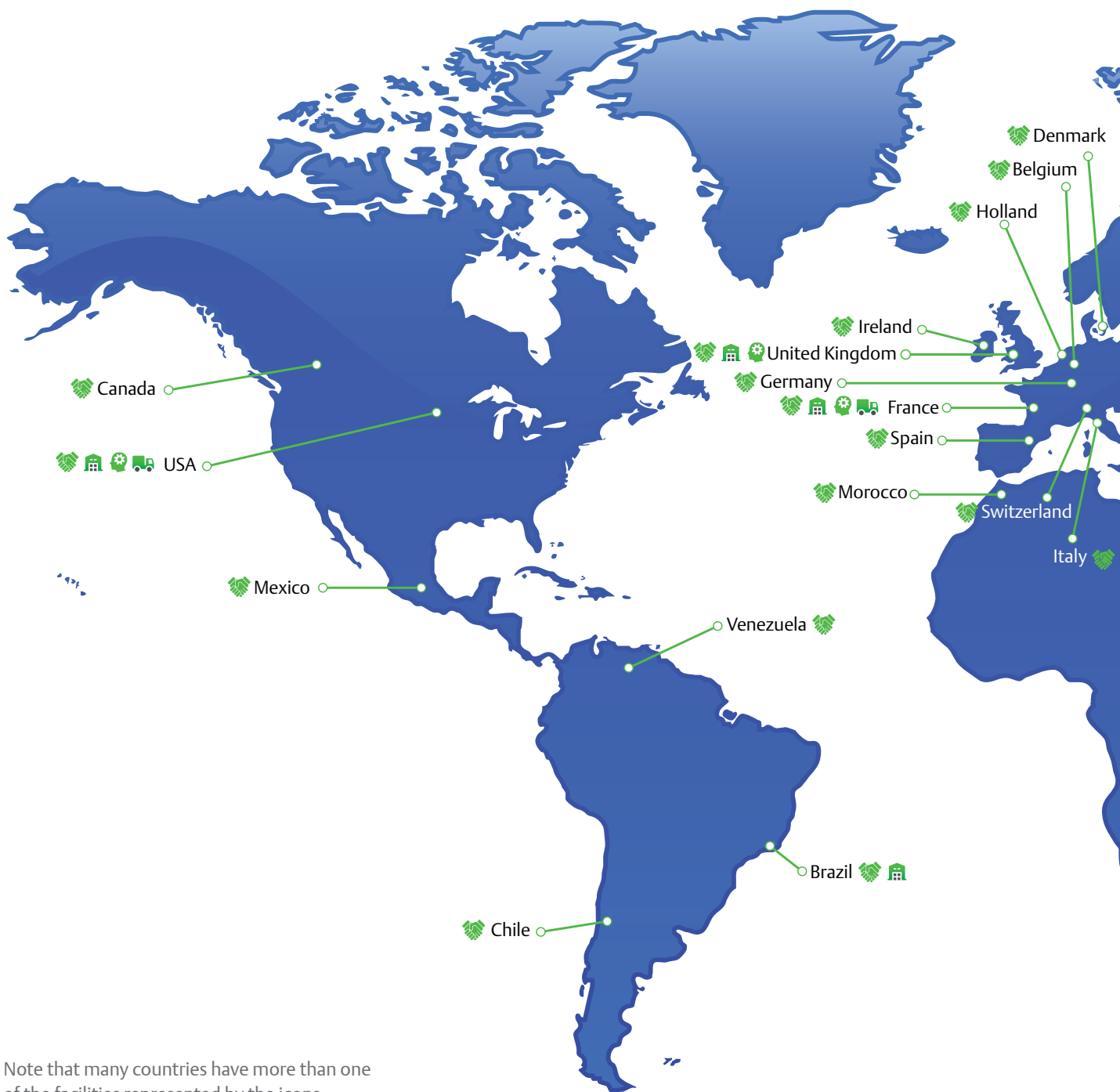


Customized local services – all elements of system requirements are supported through our worldwide Automation Center network, including design, installation, commissioning, optimization, after sales support and training

Emerson Industrial Automation adds value to your business

Through strong partnerships with end users and machine builders, we develop innovative new test stand equipment for use in industries where we can maximize the functionality of our core products. We aim to continuously add value to our customers' businesses and react instantly to changing needs. We offer tailored maintenance and servicing packages to ensure trouble-free operation. Upgrades to hardware and software can be provided as technologies advance, and we provide add-on functionality as your needs expand.

Global facilities and resources



Note that many countries have more than one of the facilities represented by the icons

A strong union that benefits all our customers

Through our integrated organization, we have an enhanced global presence with 5,500 employees. Our combined local support & services provide:



5,500 employees



40+ Automation Centers

Providing excellent customer support for any product, automation solutions or service requirements



23 Manufacturing sites

Producing a comprehensive range of high quality products, optimized for industry-specific customer requirements



8 Engineering and Design facilities

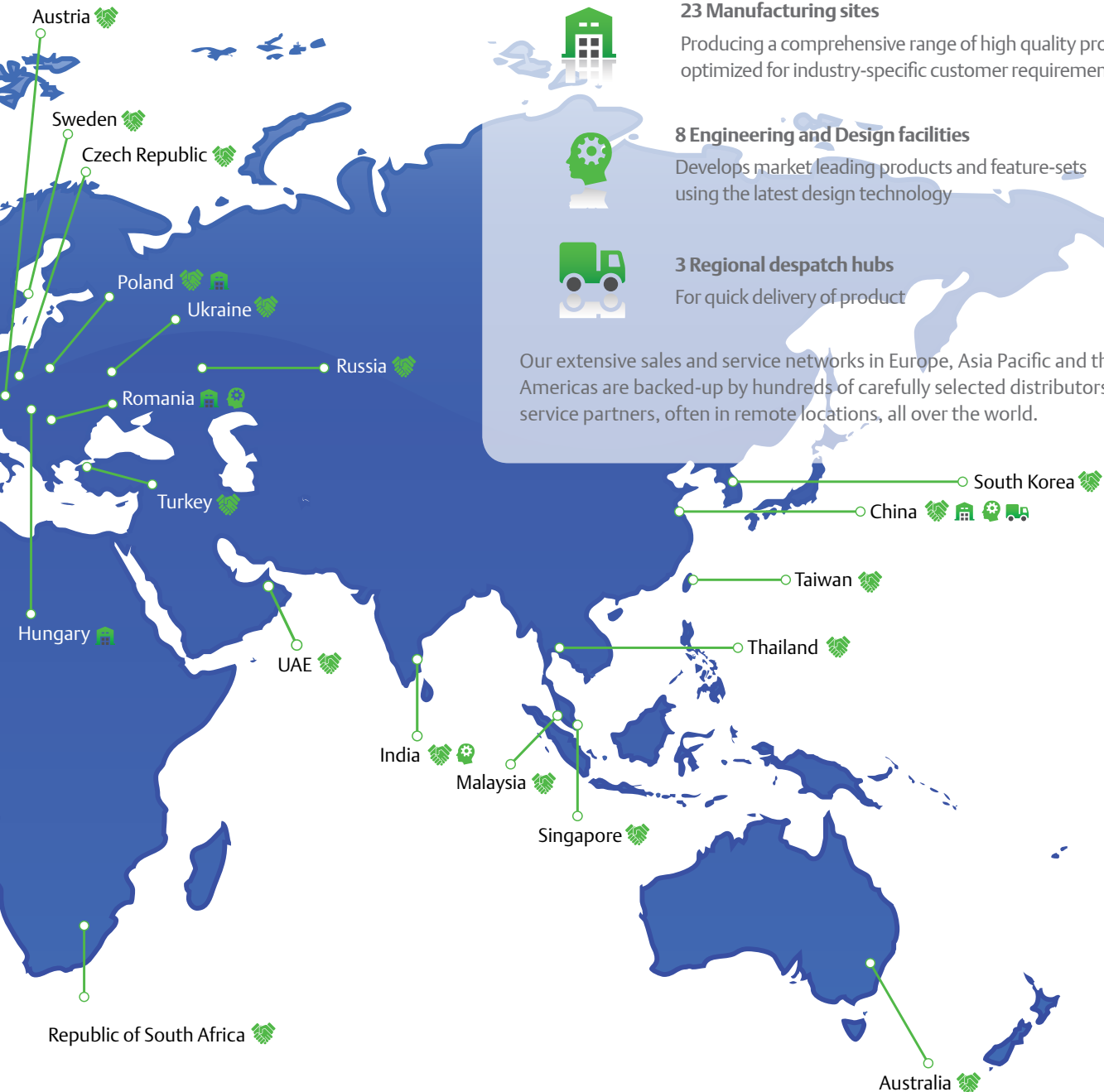
Develops market leading products and feature-sets using the latest design technology



3 Regional despatch hubs

For quick delivery of product

Our extensive sales and service networks in Europe, Asia Pacific and the Americas are backed-up by hundreds of carefully selected distributors and service partners, often in remote locations, all over the world.



Solutions for automotive, aircraft and component testing

Global expertise perfectly executed at local level

We have a group within our organization that is dedicated to designing, managing and implementing global solutions projects. This allows us to leverage and mobilize our worldwide expertise and automation knowledge across every project. Dedicated local teams based at our Automation Centers ensure each stage is perfectly executed, providing:

- Specific industry-focused solutions optimized for reliable and maximum operation
- Highly skilled system design to create innovative and energy saving solutions
- Maintenance and trouble-free operation
- Flexibility for future machine or plant expansion

Scalable automation solutions

Projects can vary from small test stand drive and motor retrofit projects to full high dynamic drive solutions. You can be assured that we are able take on completely new installations or modernize any existing installed systems, whether they were supplied by Emerson or not.

On-time project delivery, within budget

The local team provides a single point of contact for our customers, building a long term partnership while ensuring the correct resources and expertise is always available. Dedicated team roles safeguard against bottlenecks in the process, with continuous review and risk assessments ensuring responsiveness to evolving customer and project requirements. Our regional knowledge allows us to collaborate with local supply chains and easily adhere to the relevant country's industrial and electrical standards. This ensures we can guarantee project delivery is on time and within budget.



Adding value to your business

We want our partnership with you to develop over many years, continuously adding value to our customers' business. Comprehensive maintenance and servicing is available to ensure trouble-free operation, along with the following offerings:

- Management of future equipment requirements or test stand retrofit projects
- Upgrades to hardware/software as technologies advance
- On-site software development for fine-tuning automation
- Provision of add-on functionality as your needs expand
- Support for business and staff training needs where required

Comprehensive electrical solutions

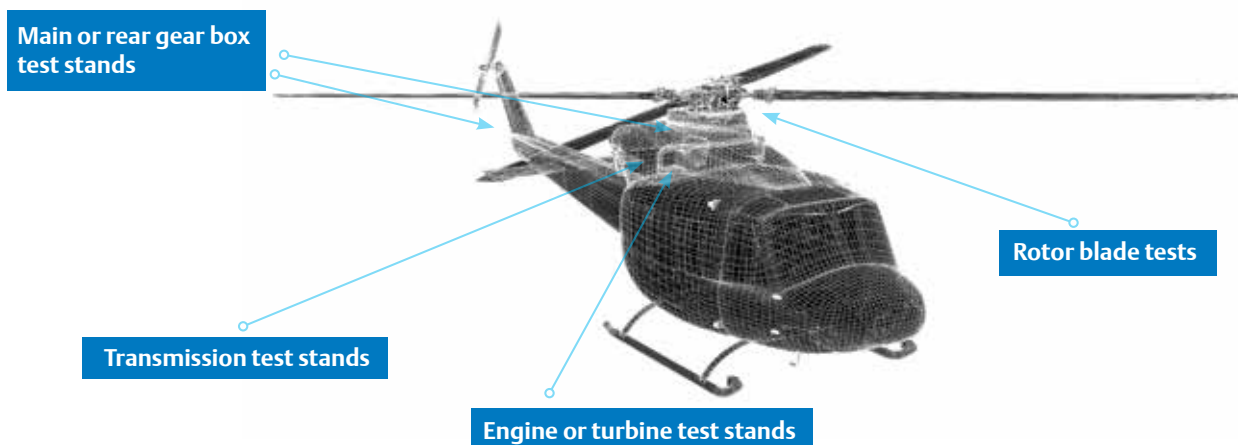
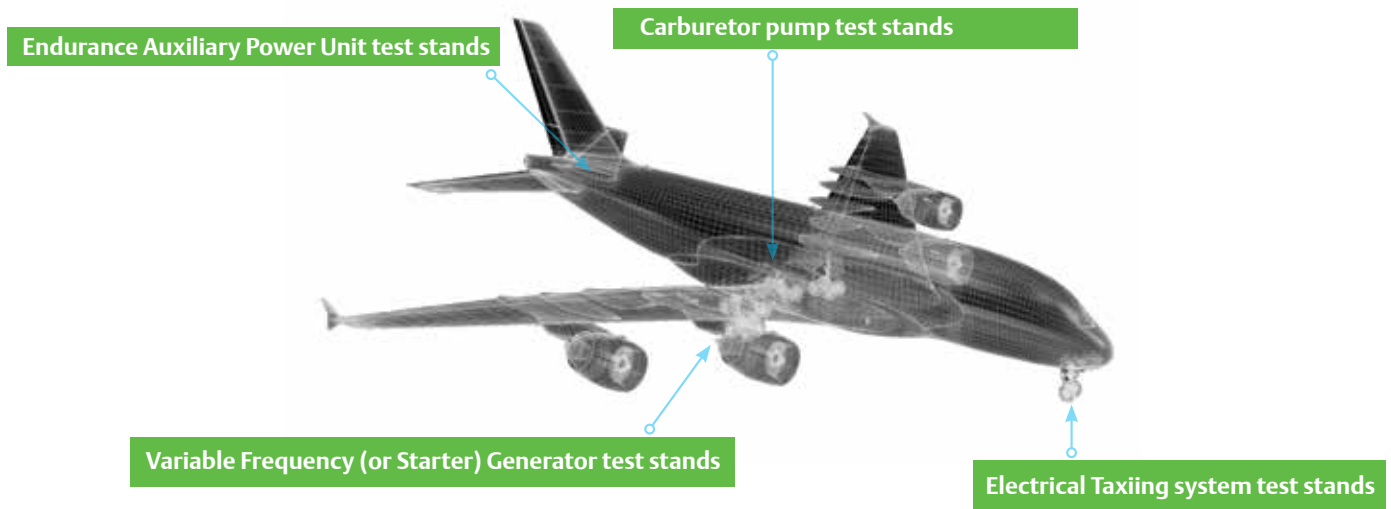
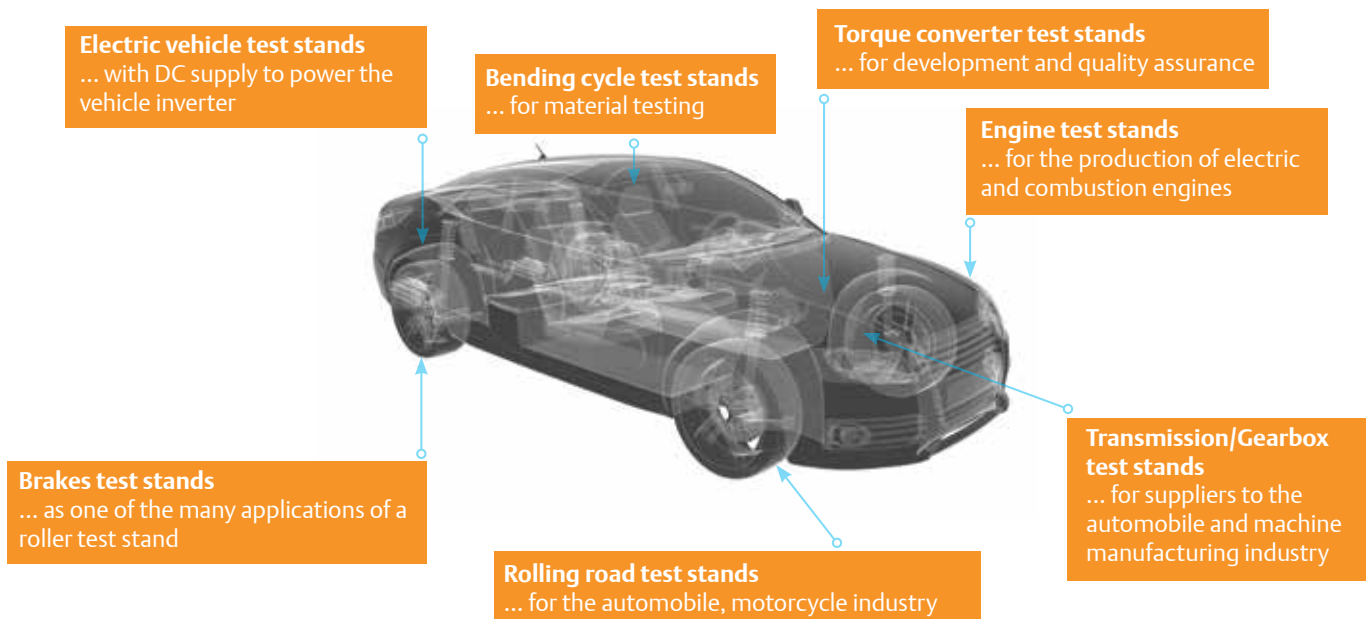
For new electric control systems or retrofit projects, we can provide fully engineered solutions. By working with a single supplier, we act as a one-stop shop for all your system and support requirements including specification, design, build and commissioning.

The project services that we can offer includes:

- Project management from experienced industry leaders
- Functional design specifications
- Detailed engineering design that incorporates:
 - Drives, motors and automation equipment that meets and improves customer's internal quality requirements
 - Integrated state-of-the-art safety controls (SIL3/PLe)
- Software application development, including:
 - Integration with PLC software
 - Customized HMI software
- Procurement of all system components
- Assembly of electrical control system, including
 - Manufacturing of cubicles and control panels
 - Installation of engineered system and cabling on site
- Factory Acceptance Test
- Site commissioning, start-up and optimization
- Detailed project documentation
- Training

Typical test stand applications

For development and production lines, we provide drive systems for the following test equipment (and more):





Rolling road and brake test stands

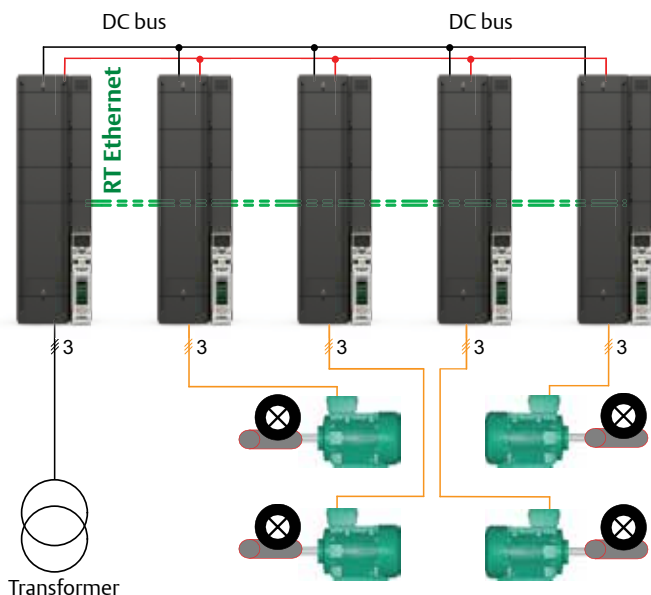
We can simulate different test profiles and tracks to reproduce driving resistances as realistically as possible, including: braking, start-up or driving round bends, cross-country and off-roading.

We can also test internal and safety-related vehicle functions such as Anti-lock braking systems (ABS) and Electric power steering (EPS). Highly accurate and reproducible measurements are obtained by taking into account the friction, electrical and thermal dependencies, and moments of inertia over the entire powertrain, through fast-response compensation.

Our Unidrive M frequency inverters meet these requirements, with over 800 established test stand installations providing testimony to our expertise and experience.

Our frequency converter control systems are synchronized. Additional SI-Application modules provide high performance independent processing, allowing the test stand drive to be dedicated to advanced management and control algorithms. The modules can be used to pre-programme test sequences and driving profiles, leaving you to concentrate on measurement analysis. Also our drive systems optimize energy consumption, using common voltage DC buses to keep excess power within the inverter system. Only the acceleration and friction losses from the test set-up are taken from the mains supply.

Final End roller test stand for motor vehicles



Applications:

- Brake testing
- ABS, ESP and Anti-slip regulation (ASR) testing
- Resonance tests and vibration detection
- Cruise control testing
- Drive train testing (2 and 4 wheel drive)
- Vehicle mass simulation
- Uphill/downhill simulation
- Performance testing
- Wind resistance
- Exhaust gas measurements



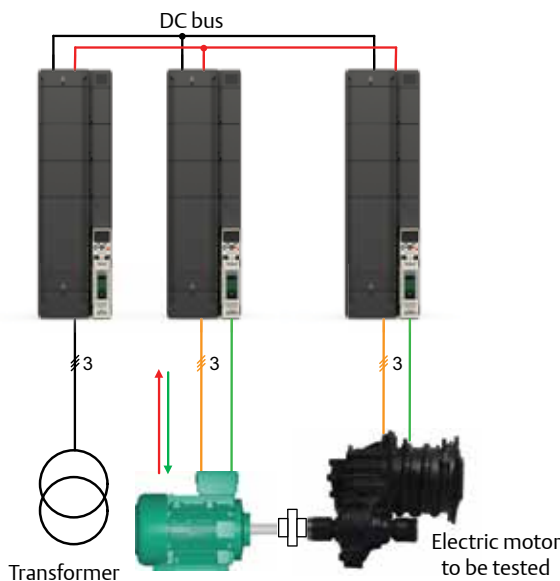
Engine test stands

Our drive systems for engine test stands are used in development centres and in motor manufacturing. As with any test stand, the key is to accurately simulate everyday operating conditions.

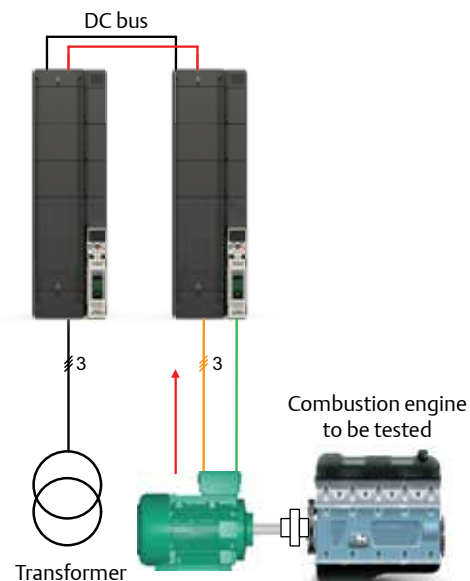
However you can also subject the test sample to specific speeds and torques that expose resonances and technological limits, for the purpose of optimization, development and quality assurance. There are specific requirements for the quality assessment of combustion and electric engines, such as different test patterns and speeds, torque and counter torque cycles, endurance tests or short-term loads.

Unidrive M frequency converter solutions allow us to accurately create the required torque curve, while also recycling the energy generated in the combustion engine, thereby sparing the electrical mains supply from sinusoidal mains currents.

Electric motor test stand



Internal combustion engine test stand



Applications:

- Service life testing
- Durability measurements
- Acoustics test stand
- Efficiency reports
- High dynamics with low-mass inertia drive engines (Fast response torque < 1 ms)

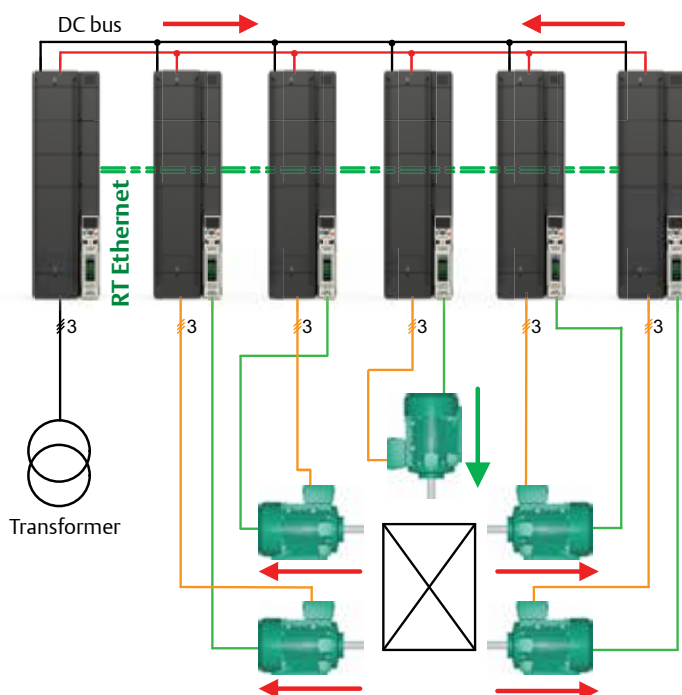


Transmission/Gearbox test stands

Our power electronics serve as input and output drives for the widest variety of transmission/gearbox types. Four load machines replace the wheel/road system and represent the driving profile (see 'Rolling road and brake test stands'), an input drive simulates the internal combustion engine. Our ETPS solution (Engine Torque Pulsation Simulation) recreates the internal combustion engine on a development test stand. To meet the high requirements for this type of test stand, we can use low-mass inertia permanent-magnet synchronous motors as well as asynchronous motors.

The torque pulses and running characteristics of an internal combustion engine are applied to the transmission/gearbox being tested. By networking all drive controllers on real-time Ethernet, we obtain the necessary synchronization of the inverter current and speed control circuits. Synchronization of the frequency converters ensures that the test results reflect real conditions. This standard feature of our Unidrive M frequency converters enables the tester to obtain optimal synchronization of the drives and avoid unwanted balancing adjustments in the control system. In addition to the drive axles, we also supply the desired loading for the transmission/gearbox to be tested.

Transmission/Gearbox and powertrain test stand



Applications:

- Determining noise and vibration problems
- Service life testing, strength measurements
- Efficiency reports
- ETPS application on development test stands
- Synchronization of all output drives
- Low-mass inertia input drives to maximize the dynamics
- Road simulation, torque calculation according to the acceleration and speeds to be simulated
- Wheel slip simulation



Testing equipment for e-mobility

New developments require new testing techniques. The powertrain of hybrid and electric vehicles, consisting of a vehicle power inverter, drive engine and transmission/gearbox, can be tested as a group with Unidrive M. In this case we power the vehicle inverter through our DC source.

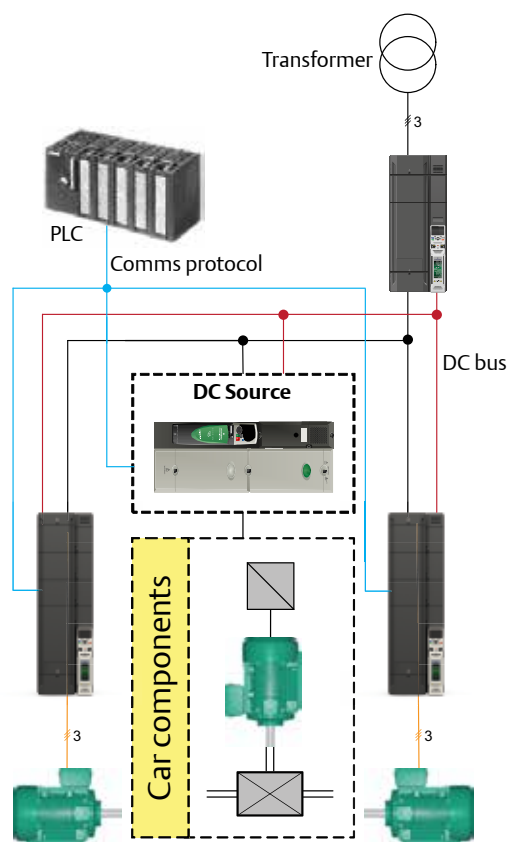
System benefits include:

- The energy required for testing remains in the test stand system, where only the losses are taken from the mains.
- Use of the installed engine power allows the mains inverter to operate with lower output, reducing the required mains energy usage.
- Only the mains inverter is used to cover the losses, at a much lower output than that of the load machines.
- No special components are required, ensuring the highest availability and a smooth testing procedure
- Realistic testing of drive components from the development stage up to the end of the production line guarantee accurate, secure and optimal test results
- A common DC bus provides a highly energy efficient system
- Resonances are prevented by synchronizing all drive control circuits over using real-time Ethernet
- Maximum control accuracy, minimum voltage wave and current ripple

Applications:

- Constant current or voltage source
- $U = 0$ to 900 Vdc, $I = 0$ to 2000 Adc
- Modular design, up to 1.3 MW
- The DC source can be connected to your existing automation technology.
- Most common communication systems are supported (e.g. CAN, CANopen, Ethercat, Ethernet etc)
- Solutions for R&D and EOL testing of motors, inverter and batteries are available

Hybrid and electric vehicle test stand with DC power source





Generator test stands

As with all vehicles, the aircraft Industry places high importance on the auxiliary energy needs, which provide crucial performance in safety and comfort systems.

Electrical developments in aircraft have seen changes such as increased power onboard, reversible energy conversion to achieve electrical starting of turbines and greater use of batteries, with goal of reducing aircraft weight.

Globally, there are four different sources of energy provided by generators in aircraft that must be tested:

1. The main electrical supply is provided by the engines (reactors) which run alternators (one per engine). These alternators produce AC (115 V – 400 Hz) and DC (28 V) current distributed through alternative buses.
2. Energy can be also provided by an auxiliary motor unit (APU) which can transform fuel into electricity. The APU can start the engine by pushing air to the turbines in autonomic mode and providing cabin air conditioning.
3. Mobile generators allow the testing and operation of hydraulic components when the plane is not flying or during maintenance operations.
4. In emergency situations a Ram Air Turbine (RAT) can produce limited energy for navigation and flying control needs.

These systems and components have to be tested during their development stage and final endurance qualification. Emerson provides drive and motor solutions for all of these requirements in new and retrofit installations.

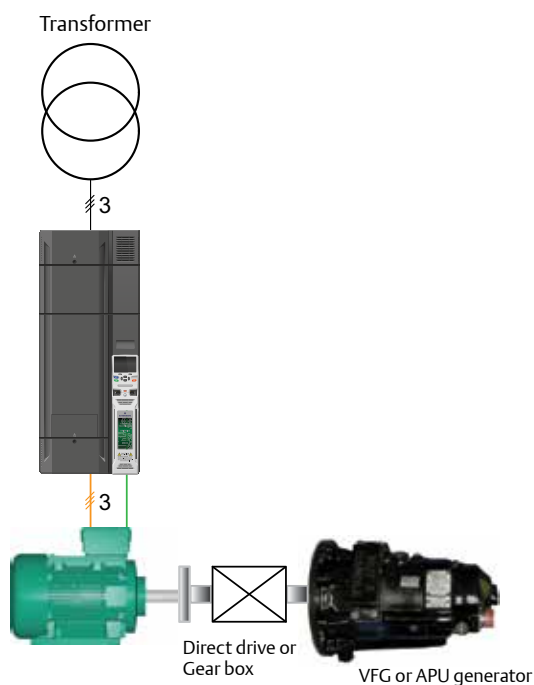
For mobile generator applications, a filter can be adapted for the drives to have a smooth output signal (where voltage and frequency are fully adjustable).

Generators tested include:

- Integrated Drive Generators (IDG)
- Variable Frequency Generators (VFG)
- Variable Frequency Starter Generators (VFSG)

Typical applications include:

- Service life testing
- Loading test
- Noise and vibrations





Pump test stands

Hydraulic power is used by the main actuators of commercial aircraft, namely the cylinders that control the rudder (ailerons, flaps, airbrakes, elevation control, direction, etc.).

Hydraulic generation is provided by Engine Drive Pumps (EDP) onboard, which are driven by high pressure reactor compressors. In an emergency case, a Ram Air Turbine (RAT) can also operate a pump to pressurize one of the three hydraulic circuits.

Hydraulic circuits are also present for the fuel supply system of the motors. These work naturally with pumps and valves from the tanks to the engines.

For fuel pumps, the testing of overpressure must be performed with high speed accuracy with 1 rpm steps most of the time.

For military or aerospace industry applications we produce drive pump for carburetor, where dedicated tests are performed to check kerosene flow, compressed air rates and cooling levels.

These systems and components have to be tested during their development stage and final endurance qualification. Emerson provides drive and motor solutions for all of these requirements in new and retrofit installations.

Pumps tested include:

- Engine driven hydraulic pumps (EDP)
- Fuel or kerosene pumps
- Carburetor pumps

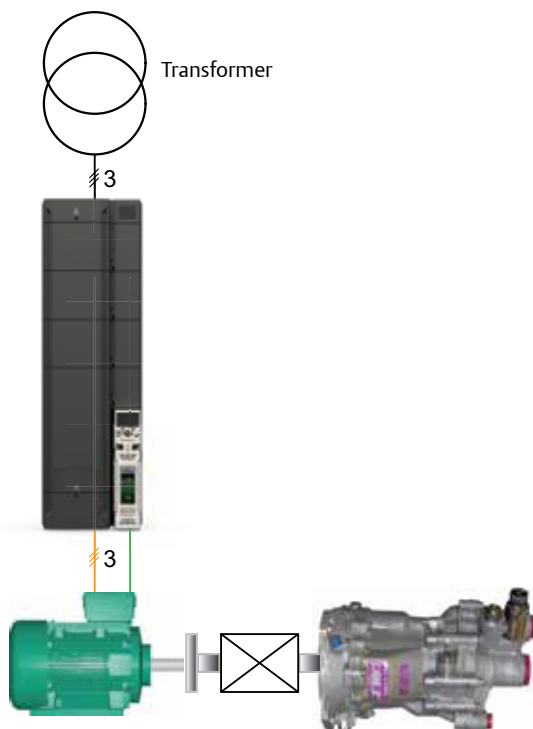
Typical applications include:

Static pressure

- Testing the high dynamic pulse pressure
- Burst tests
- Circuit characterization and components

In-flow pressure

- Leak tests
- Safety valve tests





Component test stands

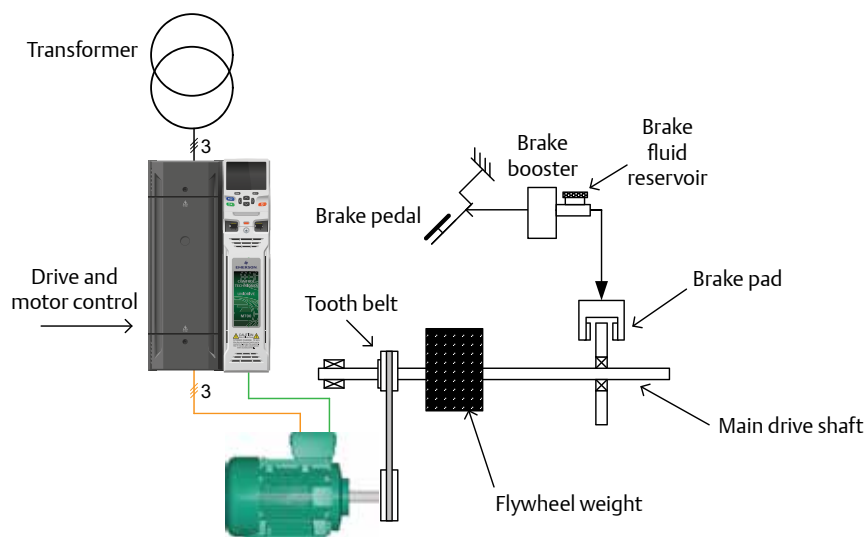
For automotive, aviation, aerospace, railway, military and many other industry sectors, a significant amount of stands are dedicated to testing components. This trend is generated by global performance, reliability and safety requirements of each system, with this level of testing providing more realistic loads at component level.

Component stands are used during research and development, qualification, endurance and production stages. A component test stand is also cheaper than a complete test stand.

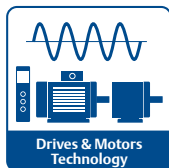
For all these needs, Emerson provides motor and drive solutions for new or retrofit installations.

Typical component testing includes:

- Bearing tests
- Rotating group test
- Cylinder tests
- Air compressors
- Turbine of aircraft and helicopters engine testing
- Alternators starter test
- Shock absorbers
- Clutches
- Drive line
- Ram air turbine tests
- Tooth belts (CAM)
- Vehicle door hinges
- E-mobility components
- Balancing rigs
- Tooth-belt









Schematic representation of brake pad test



Drives and motors technology

Typical components for test stand applications include:

Drives and Controllers	AC drives		DC drives	
	Unidrive M Modular design up to 2.8 MW (4,200 hp) 200 V, 400 V, 575 V, 690 V <ul style="list-style-type: none"> • STO function (1/2 channel) • MCI processor, with full access to all drive parameters • Ethernet IEEE 1588 V2 comms, IEC 61131-3 (CODESYS) programming and high speed I/O • All major fieldbuses • SD card for backup • Parameter settings are switched from engine to mains inverter by modifying a single parameter • 6p / 12p / 24p / regenerative input bridge • Selectable brake chopper • 2 to 16 kHz frequency • Low losses up to 98 % 		Mentor MP High performance DC drive with field control and integration flexibility 25 - 7,400 A 400 V, 575 V, 690 V <ul style="list-style-type: none"> • 2 or 4 quadrant operation • Three option module slots for automation control, I/O, feedback devices and communications • Smartcard for back-up • Ideal for upgrading existing DC based dynamometer rigs • DC drive based on modern AC drive technology • Advanced DC control algorithms for high performance • Unique galvanic Isolation utilising patented technology 	
Motors	AC motors			DC motors
	IMfinity® Induction motor IEC frames - IE3 IP23 and IP55 - Cast iron or cast aluminum housing 0.75 - 900 kW (1 - 1200 hp) 	LSMV Flexible 3 phase motor with encoder and forced ventilation options - IP55 0.75 - 132 kW (1 - 180 hp) 	CPLS High performance and compact motor designed to offer a reliable and adaptable asynchronous variable speed solution - IP23 or IP55/IC37 7.5 - 560 kW (10 - 750 hp) 95 - 2,900 Nm (70.1 - 2,138 lb.ft) 0 - 10,000 rpm 	LSK Drip proof and enclosed DC motors delivering constant torque at variable speed 0.1 - 750 kW (2.5 - 1,000 hp) 

Emerson motors comply with IEC standards. We are also able to deliver NEMA rated motors from 3rd party suppliers.



Emerson customized services and support to ensure optimized operation for the lifetime of your system

To back our innovative solutions, our Automation Centers can provide the following local services, to ensure the continued optimized operation of your application, including:

- Full field servicing capability
- Extensive after sales support
- Inventory audit solutions to ensure only minimal spares are kept in stock
- Localized and application specific content for support documentation including wiring diagrams, certification files (CE & UL) and integration manuals

Customized local services and round the clock support

We also provide a range of expert local services tailored to meet our customers' expanding test stand requirements, while guaranteeing an exceptional response to emergency situations with round the clock support. Customized policies are defined locally and can include:

- 24/7 remote support
- Rapid response, with agreed timescales, to requests for onsite issues by skilled local support teams
- Full application analysis to identify further areas for improvement



Customized training

Scheduled training courses are available for your specific application and held onsite in many regions, or your designers, programmers and maintenance staff can attend regular courses offered at our local training centers. Typical training from industry experts can cover:

- Application operation
- Start-up and shutdown best practices
- Troubleshooting
- Periodic tuning of operating parameters and revision of system settings to improve production

Quick reactivity to customer requirements with Express Availability service

Our industrial organization and regional distribution centers mean that drives, motors and options are available locally and are dispatched quickly as standard. This helps ensure continuity of production and minimized spares required onsite.

Our Express Availability service, available in many regions, offers very short lead-times on many product combinations, including drives, motors, brakes, gears and options to meet critical requirements.

EMERSON. CONSIDER IT SOLVED.™

www.emersonindustrial.com/automation



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