



# HIGH PERFORMANCE DRIVE SYSTEMS FOR TESTING APPLICATIONS



# UNICO TEST STANDS

## Market Leading Solutions

UNICO has been developing application specific solutions since 1967.

In introducing a modular approach to drive design and innovation, UNICO engineers have been able to capitalize on the flexibility of this approach consistently achieving the optimum performance and functionality for the leading innovators within each market sector.

This design philosophy offers customers the benefits of:

- High Performance
- Low Risk
- Flexibility
- Scalability
- Short Development Cycle
- Defined Project Timelines

	Motorsport	Automotive	Off Highway	Military	Aerospace
ENGINE DYNO	●	●	●	●	
TRANSMISSION DYNO	●	●	●	●	●
CHASSIS DYNO	●	●			
HYBRID DYNO	●	●	●		
BATTERY SIMULATOR	●	●	●	●	
BATTERY TESTING	●	●	●	●	
TORQUE PULSATIONS	●	●	●	●	●
COMPONENT TEST	●	●	●	●	●
FEAD TESTING	●	●	●	●	●
MOTOR SIMULATION	●	●		●	
ULTRA HIGH SPEED	●				●
END OF LINE (EOL)		●	●	●	●

# UNICO SERVICES

From Design to Delivery and Beyond

When you are constantly striving to push forward the boundaries of both technology and performance, you need a partner that you can rely on to meet those challenges.

With an unparalleled level of engineering expertise and a long history of working with the top names in the Motorsport, Automotive and Aerospace sectors, UNICO is the logical choice when performance, reliability and accuracy are paramount.

UNICO is able to take your project from design concept through to final commissioning in a professional and timely manner. Unico will then continue to support you in order to maximize the return on your investment.



Design Concept



Motor and Drive Selection



Specification and Drawings



System Assembly



Test and Customer Inspection



Delivery to Site



Installation



Final Commissioning



Support

# HIGH PERFORMANCE DYNAMOMETER DRIVES

## At The Peak of Performance For Five Decades

When designing engines and drivetrains for the future, you need a drive system that can meet not only the demands of today, but also the challenges that technology will place on the system in the future.

Working closely with our customers, UNICO engineers and designers are constantly striving to push the performance envelope even further, with higher powers, higher speeds, more dynamic response and faster communications.

Because much of what UNICO builds is designed to meet a specific requirement, we have always been able to anticipate changing market trends.

Unico has been quick to realize new technologies for testing all aspects of electric vehicle systems - from power packs to propulsion. We have incorporated performance characteristics within our drive systems to suit the new trend for smaller power units with fewer cylinders, higher power density and peak torques.

- Nominal power 1.0 - 5,000kW
- Supply voltages (1ph/3ph) - 230V, 460V, 520V, 575V, 690V
- AC Input, DC Input and Regenerative Models
- IGBT switching up to 30kHz
- Frequency control up to 2,000Hz
- Torque response 1 millisecond
- Acceleration rates up to 300,000rpm/second
- Motor speeds up to 120,000rpm
- Torque estimator 0.5% accuracy (0.1% calibrated)
- Dual Fast Vector Rotator
- NVH Low noise speciality
- Wide range of interface options
- AC Induction, SPM, IPM, and DC Motor Control
- Supports Battery Test, Battery Simulation, and Motor Simulation



# BATTERY TESTING & SIMULATION

Battery Simulation and Battery Cycling, - Fixed and Portable Solutions

UNICO has been building and supplying battery simulation and battery testing systems for more than 15 years.

In response to market requirements, Unico has developed flexible solutions for battery testing, including modules with standard ratings that can be connected together in series or parallel for increased voltage or current.

Battery simulation is often supplied as a common DC bus design for integration into a system with other UNICO drives, thus providing a complete solution for Hybrid and EV drive train testing.

With a proven technology and a wealth of field experience, the engineers at UNICO are constantly raising the bar to meet the demands of this dynamic market.

## Ratings

- Battery testing / simulation < 5MW / 1,800Vdc / 4,000A

## Accuracy

- Voltage  $\pm 0.05\%$  full scale
- Current  $\pm 0.05\%$  full scale
- Resolution 16bit
- Current slew rate - 50,000 amps/sec (Typical)
- Voltage slew rate - 10,000 volts/sec (Typical)
- Configurable output resistance  $\pm 1,000m$  ohms

## Response

- PWM freq - 1-20kHz
- Delay Time - <1ms
- Rise time - <0.63ms
- Settle time - <2ms

## Options

- High Accuracy Remote LEM
- High Accuracy Remote Voltage Sense



# E-AXLE DYNAMOMETER

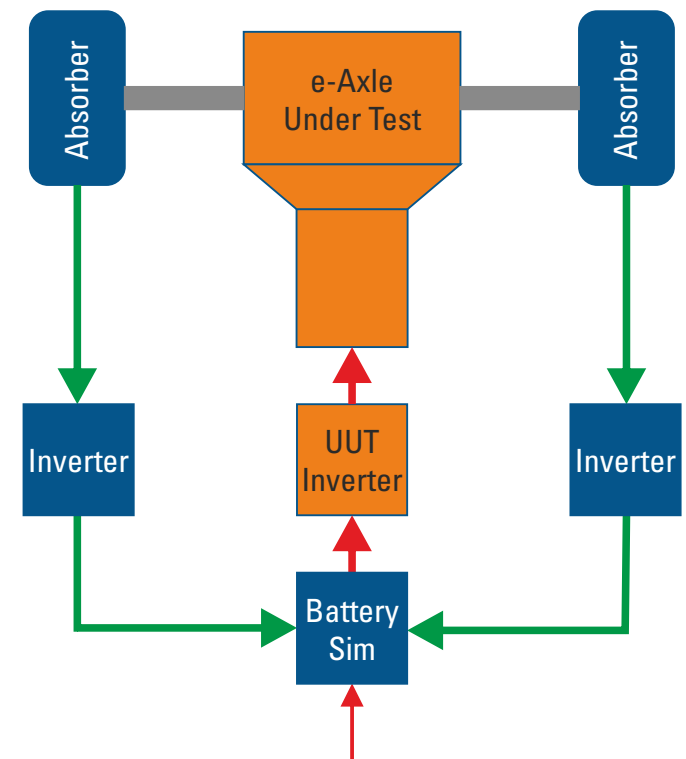
## At the Forefront of the New Technical Revolution

- High torque synchronous and asynchronous absorber options
- High efficiency energy re-circulating design with Common DC Bus limits impact on existing power network infrastructure and reduces operating costs
- Single control interface to all major control systems
- Accurate and repeatable test runs
- Flexibility - Dual independent 2WD systems can be combined into a single 4WD system (purely via a software interface)

Unico has e-Axle solutions to cover a wide cross section of customer requirements, from end-of-line test rigs to research and development platforms.

Unico's modular drive concept allows for multiple types of drive elements to be connected to the common DC Bus. This enables Unico to provide a fully integrated e-Axle dynamometer system in a single package.

The design of this type of system not only allows energy recovery over the common bus, but also offers a level of flexibility to configure the system architecture. This type of configuration is not normally possible with standard off-the-shelf drive designs.



With the entry of the high performance manufacturers into the EV marketplace and the opening-up of the Formula-E regulations to allow alternative motor manufacturers, the demands of high speed testing are continuously pushing the speed requirements higher.

Drawing from a vast experience of high speed applications, Unico is uniquely placed to overcome the technical complexities and challenges that these evolving applications present.

# HIGH SPEED SOLUTIONS

From 20,000rpm to 120,000rpm

- Unico offers a range of synchronous and asynchronous high speed motor solutions
- Ability to characterize and control IPM motors with optimal torque per amp using control algorithms and auto-setup routines built into the inverters.
- e-Motor solutions up to 30,000rpm @ 300kW ( $J_{mot} = 0.008\text{kgm}^2$ )
- Energy recovery and e-Turbo solutions up to 120,000rpm
- Low torque and current ripple reduces rotor heating
- High switching frequency up to 30kHz
- Water cooled motors and drives
- Switching on the fly optimises the available power across the whole speed range
- Reduced overall package size in comparison to traditional drive technology



Unico understands that NVH testing brings its own unique set of challenges. These challenges cannot be met by a standard off-the-shelf drive system.

Unico's solution offers many unique features that will avoid the Dynamometer distorting the test results with its own shortcomings.

This enhanced performance is achieved using our unique dual processors and dual current regulators. This level of performance has kept Unico at the forefront of specialist test stand drives making Unico the first choice of the top R&D engineering teams for many years.

# NVH TESTING

## Noise Vibration and Harshness

- Ultra Quiet Operation
- High Switching Frequency
- Low Torque Ripple
- Fixed Switching Frequency
- Soft IGBT Switching
- High Frequency Torque Pulsation
- Gear Rattle Replication

### Benefits:

- Tried and Tested formula
- Many Systems Operational Around the World
- Interfaces With Most Software Systems

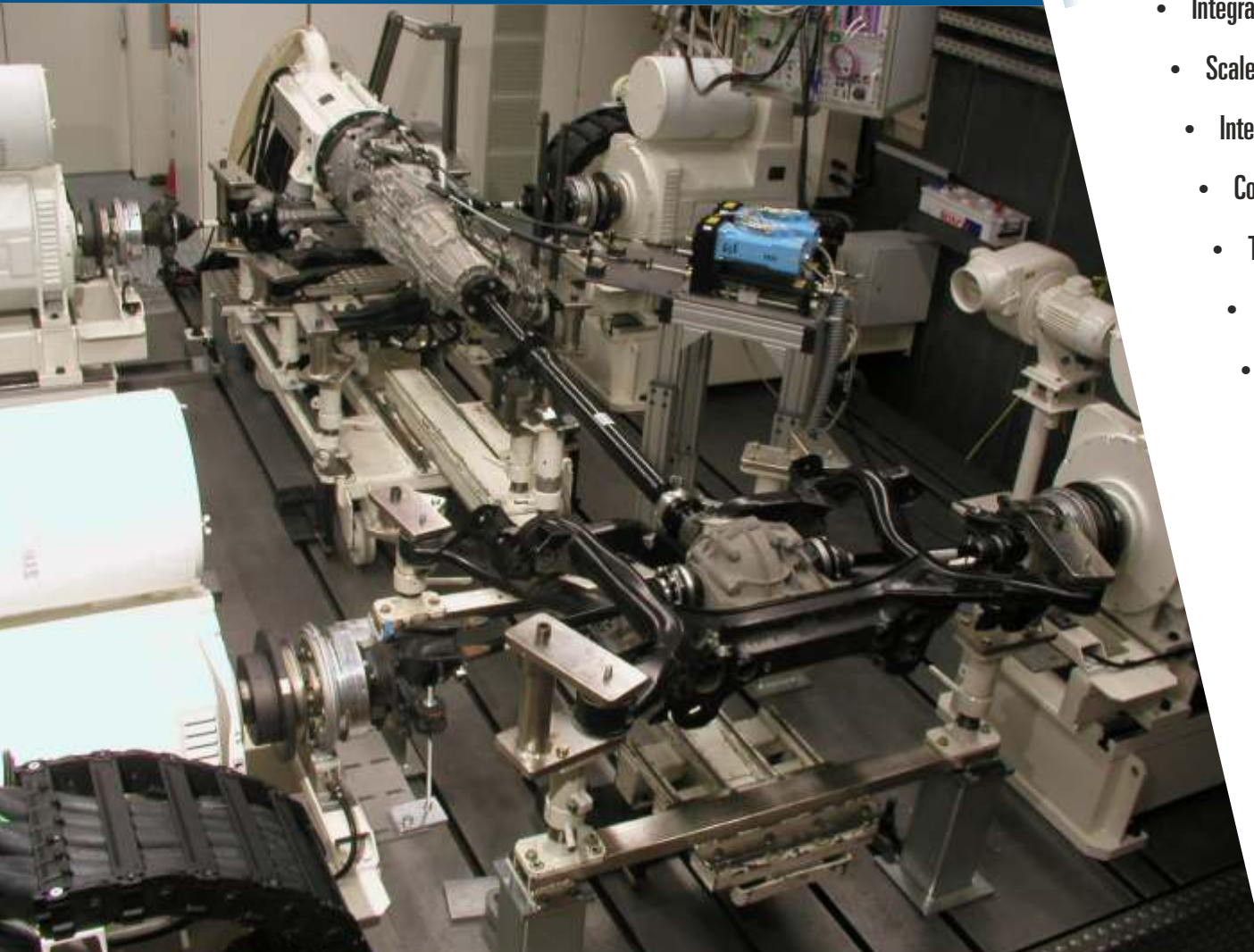




Unico is uniquely placed to be able to supply a complete drive train solution. Torque transducers, motors and drives are just the starting point.

Using our own in-house system building capability Unico is able to supply a completely tailored and engineered solution. This might be anything from a single axis system to 2 wheel drive, 4 wheel drive, hybrid, full electric - the possibilities are almost limitless.

Unico can also provide on-site commissioning support and training.



# TRANSMISSION DYNO

## Multi-Axis Systems

- Torque Pulse Simulation / Dynamic Load Pulsation
- Inertia Simulation / Compensation
- Integrated Battery Simulation for HEV
- Scalable Design
- Integrated Hybrid Solutions
- Common DC Bus (Energy Sharing)
- Torque Vectoring
- Total Torque Control
- Dynamic Torque Estimator

### Benefits:

- High Performance
- High Functionality
- Integrated Technology Functionality
- Flexible Design
- Simple Control Interface
- Compact Design

# ENGINE DYNAMOMETER

## From Low Power to High Performance



Whether it is dependable, repeatable End of Line (EOL) testing for the production department or the performance and flexibility required by R&D to develop your next generation High Performance Engine, Unico has a lifetime of experience in supplying the right solution for your requirement.

Unico's wide range of modular drives allow us to develop cost effective solutions to meet your exact testing requirement without the need to compromise on either performance or functionality.

Our Low Inertia solutions offer a (> 75%) saving in Inertia compared to conventional AC Dynamometers - allowing you to closely match the test requirements over a wide range of products.

Special features, such as 'Switching on the Fly' allow us to accommodate the differing needs of both Gasoline and Heavy Fuel engines without the need for major alterations.

When space is at a premium, our high-efficiency drive packages allow Unico to design compact drive systems to fit into the tightest of spaces. Our range of water-cooled drives offer a space saving of up to 60% over our already compact air-cooled drives. Removing the requirement for HVAC in the control room can save around 30% on the cost installation - not to mention the savings in ongoing operating costs.

- Ratings up to 5MW / 27,000Nm / 35,000rpm
- Permanent Magnet and Asynchronous Motors
- Dynamic Torque Estimator (<0.5% O/L - <0.1% C/L)
- Low Inertia Solutions (>75% Saving in Inertia)
- Inertia Compensation / Simulation functions
- Regenerative / Active Front-End
- Air-cooled and Water-cooled Drives (<60% space saving)
- Changing Switching Frequency on the Fly

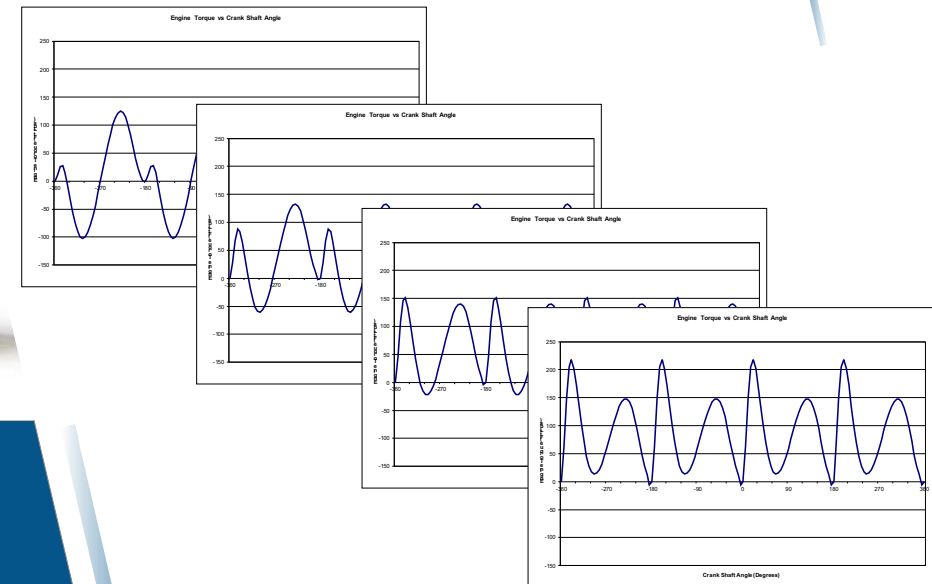
### Benefits:

- High Performance
- Flexible Testing
- Low Inertia
- Compact Design
- Energy Savings
- Proven Solution



# ENGINE SIMULATION

## World Leaders in Torque Pulsation Technology



With parallel development of powertrains becoming ever more necessary, engineers are constantly searching for solutions that will closely model the characteristics of the power plants of the future, whether this is ICE, HEV, PHEV or BEV.

Having had a long association within the motorsport sector and working at the very pinnacle of performance, UNICO has developed torque pulsation strategies that are unparalleled within the industry.

Unico's unique approach locks the torque pulsations to shaft position in order to closely replicate the operation of an ICE. Mapping 720 points per cycle creates a very complex and accurate simulation. This torque profile can be modified dynamically up to 50 times per second to reflect changes that occur with engine speed, throttle position (torque), etc.

This engine modelling can be derived by entering the engine's parameters into the drive system. Alternatively you can import captured data from an existing engine design, or stream live model data from your engine simulation via a high speed digital interface.

- Allows parallel development of drive train components
- Very accurate torque pulsation modelling algorithms
- Can be interfaced with all popular test stand controllers
- Simple and dynamic interface to a wide range of simulation and engine modelling software
- Wide range of communication bus standards
- A clean and efficient way of testing drivetrain components
- Accurate and repeatable test runs

# UNICO AUTOMATION AND TESTING CENTERS OF EXCELLENCE



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