KISTLER
measure. analyze. innovate.

KiBox2 –
powertrain measurement

Analysing complex propulsion systems in real time

Combustion engine

Engine control unit

CAN messages digital out

KiBox2

Sensor signals

Calculations
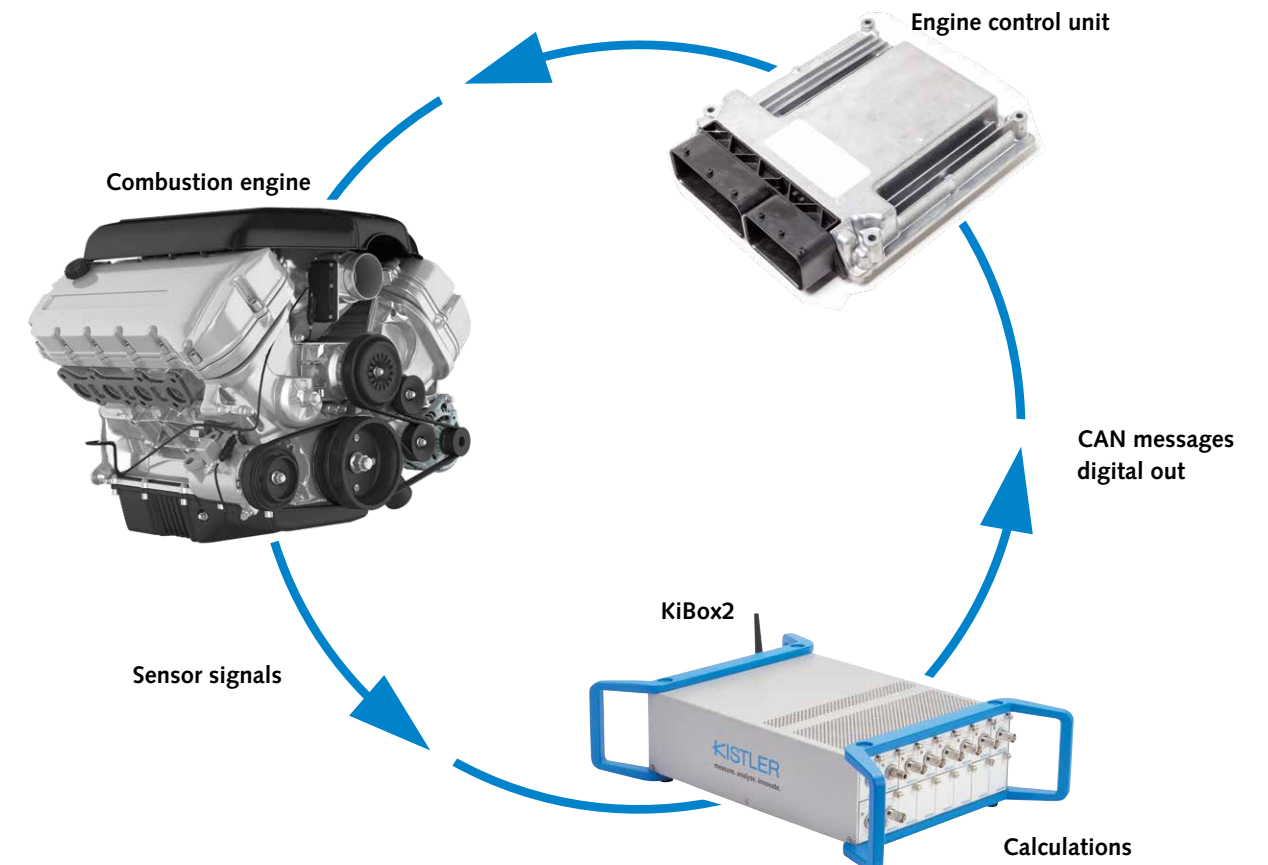
Engine development in-vehicle and on the test bench made easy

Today's engineers need high-precision results from their measurements, as well as flexible processes and an efficient way of validating the large volumes of data from the test environment – either at engine test benches or from on-the-road testing.

With KiBox2, engine developers now get a tool that offers broad functionality and high-performance processing power to assist them in every phase of their work. A single, flexible, across-the-board solution is the only way of achieving results that are consistently valid and comparable right the way across the engine development cycle.

High-level support in all stages of the development process
As successor of the technology leading KiBox, KiBox2 is a complete combustion analysis solution – for use in-vehicle and on the test bench. It delivers the essential calculated metrics on combustion quality and efficiency, for each individual cylinder and provides all the key engine development data in real time.

New Energy Vehicles
KiBox2 is capable and equipped for the analyses of complex and electric powertrains, from single components to full electric and New Energy Vehicles: it provides the measurement channel attributes and calculation power to fully capture propulsion system inputs and responses – along with the software capability to visualize and analyse application specific e-machine data.

KiBox2 – driven by innovation
- Designed from the core to merge technologies
- Reliable and recognized Kistler precision
- State of the art user interface with active user guidance
- Intuitive handling and simplified workflows to increase efficiency
- Combined measurements and calculations for all prime mover types
- All raw data stored and available for post processing and analysis

One system – two pillars
KiBox2 and KiBox Cockpit were developed together to work as one harmonious system for the user, independent of system configuration. Designed for optimum efficiency during set-up, measurement and review – with a clear task split and user guidance through the different states.

Handling and usability
KiBox2 leverages the use of the latest generation tablet devices and is optimised for in-vehicle operation with an increase radius of movement now possible around the test object. KiBox2 can also operate as a wireless hotspot allowing easy remote access to the device if required. Voice feedback and control allows hands-free operation during test drives, all via a "Hey KiBox" command set.

Advanced real-time performance
Verified real-time performance allows closed-loop control or even in-cycle control of an engine or unit-under-test. Advanced recording triggers allow complex measurement scenarios to be handled with ease. "Smart Sync" technology ensures that data is securely stored, backed-up and managed efficiently, continuously and safely.

Key parameters direct from KiBox2
In-cylinder pressure "normal" and "abnormal" combustion metrics
- Knock and ignition
- Peak pressure and its angular position
- Indicated mean effective pressure
- Heat release
- Energy conversion values and combustion duration
- Ignition and injection timing
- Engine speed
- Peak pressure rise and its angular position
- Combustion noise
- FFT
- Statistical evaluations of all parameters
- Any desired result from user formula calculation

Electric machine efficiency characterization metrics
- Active, reactive and apparent AC power per phase
- Power factor
- Phase angle
- DC power (inverter input)
- Mechanical power (via add. torque flange)
- Power conversion efficiencies

In-vehicle measurement: fast, simple, precise

For several in-vehicle calibration tasks, a mobile powertrain measurement system is the optimum. That is why KiBox2 is an ideal solution featuring a host of innovative functions specifically tailored for efficient powertrain measurement.

Realistic characterisation of real driving conditions is an increasingly important factor in optimising the performance of the powertrain holistically. Physical boundary conditions that impact propulsion system behaviour can only be replicated on a test bench to a limited extent; in many cases, understanding of the highly complex inter-dependencies are required for being able to characterise the complete powertrain behaviour.

Maximum accuracy and usability
Engineers and developers need measurement system flexibility, along with reactivity when it comes to control unit calibration and trouble-shooting prior to start-of-production. A mobile capable, powertrain measurement system is the key to straightforward validation of test bench results in on-road and in-vehicle testing. With KiBox2, calibration engineers, working on road or track, acquire an efficient tool chain for in-vehicle use that offers wide ranging functionality and processing power – before, during and after the measuring runs.

Synchronous integration into ECU calibration systems (MCD)
KiBox2 supports synchronous integration of results into control unit calibration tool chains via standard interfaces (XCP, CAN). Remote control synchronous recordings are easily possible and allow high fidelity data synchronisation on the fly.

1. Cylinder pressure sensors and adapters, e.g. glow plug adapters
2. Current clamps for injection timing and/or ignition timing
3. Crank angle adapter to connect to the vehicle's flywheel sensor
4. Wireless or Ethernet connection to indicating unit
5. KiBox2 with measuring modules
6. Current clamps and differential voltage probes for e-power train analysis

Automatic data storage
In addition to the manual trigger option, KiBox2 offers advanced automation of measurement procedures for in-vehicle tasks. Based on the conditions specified by the user, the data recording and storage is triggered automatically. The vehicle position information can also be recorded during the entire test drive, and is stored within the data model as GPS coordinates.

Stand-alone operating mode
If no space is available or if the environment is unsuitable for an operating PC, KiBox2 can also be operated as a stand-alone solution. In this case, it can continuously transmit data via external interfaces, or it can automatically store data locally to hard drive. WiFi connectivity allows remote access to the KiBox2 without any hardware connection being required – ideal for data transfer during track testing.

CrankSmart enhances data quality
No encoder? No problem! KiBox2 has a sophisticated angle mark processor that handles the crank angle and top dead centre with the standard flywheel configuration (used for OEM engine control systems). This significantly reduces the setup effort and provides absolute comparability between test bench and mobile measurements.

Advanced analysis on-the-fly
KiBox2 has a powerful, multi-core onboard signal processor and formula compiler which is fully optimised for real-time calculation. This allows the users to embed their own logic and algorithms for execution during measurements – leading to higher efficiency as the required data is available at the right time to support crucial engineering decisions.

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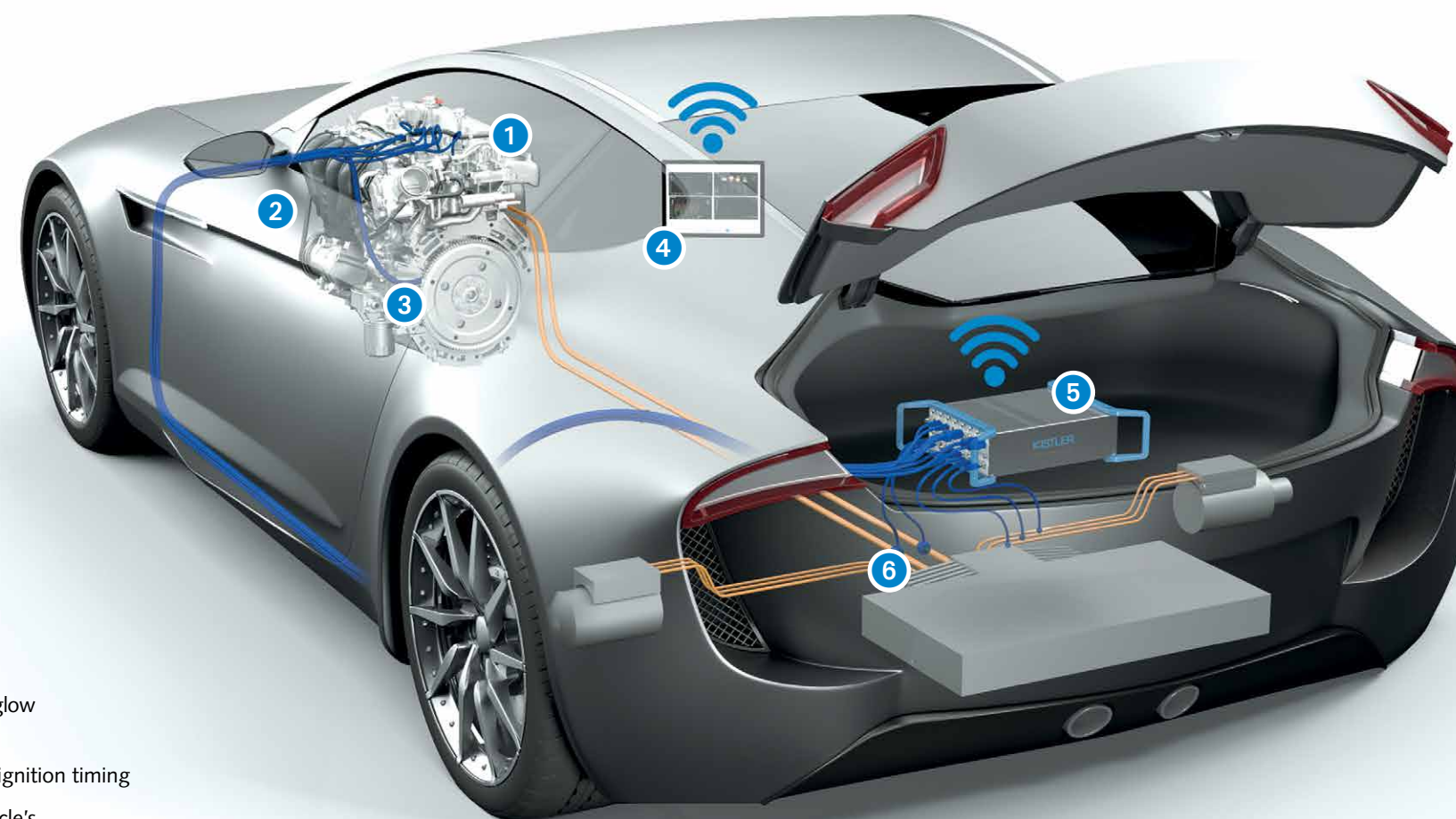
Test bench measurement: valid, comparable, versatile

KiBox2 offers an extensive range of functions for test bench testing and application. The system is capable of fulfilling the requirements of providing data to the whole power unit development process – from early concept studies to final calibration and validation activities.

When working on test benches, the channel count requirement is typically higher. KiBox2 is fully capable and extendable for addressing the needs of future powertrains that combine combustion engines with electric machines for propulsive force generation. Thanks to its complete new hardware and software platform, KiBox2 supports a wide range of technical requirements and specific features. The user interface supports and guides the user through the system setup, measurement and data review process.

High channel count and versatile interfaces
Easy integration at the test bed is important. KiBox2 offers numerous interfaces for seamless connectivity into the test bench environment (CAN-FD, XCP, Remote Control API). KiBox2 supports all commonly used interface protocols between the high-speed measurement and test automation systems.
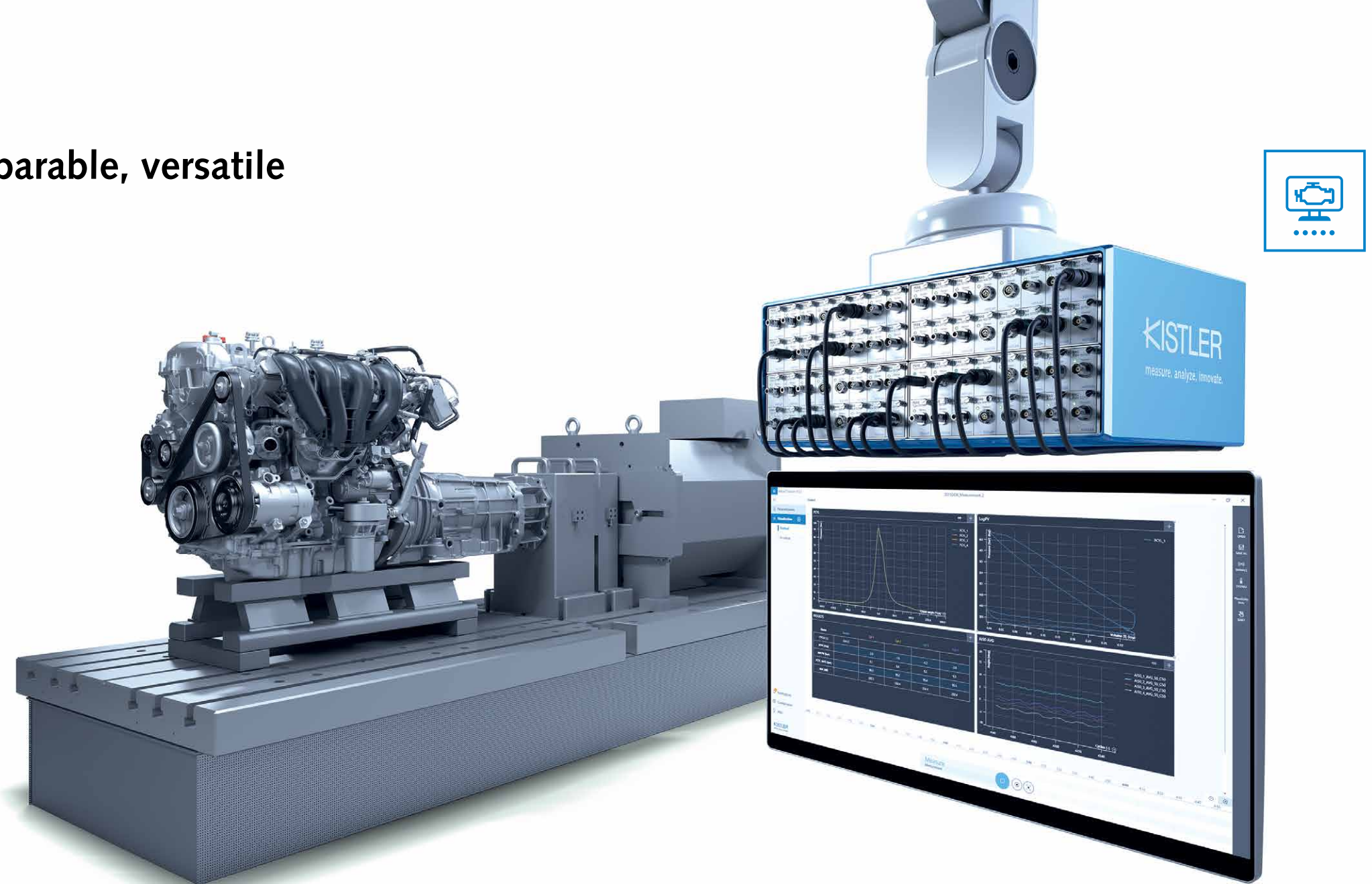
Optimised user experience
The KiBox2 Cockpit software has been developed with user efficiency as a top priority. This all new and advanced measuring system creates a hardware platform and software eco-system ready for all current and future challenges, supporting development engineers to be able to produce efficient powertrains which reach all design targets with the minimum development time.

Precise and flexible angle sensing
Three options are available for rotational position sensing, allowing for maximum flexibility and re-use of existing facility equipment. The advanced angle mark processor enables measurement with no additional encoder at all – via the well proven CrankSmart system. All data is always available in angle and time domains for the broadest possible coverage of measurement requirements.

High-Performance individual data visualization
The KiBox2 Cockpit comes with advanced post-processing and exporting capabilities. All the necessary display objects are available from a single click to facilitate fast analysis of data immediately during measuring tasks. Data can be exported to files using numerous standard formats to allow efficient workflows with existing, standard offline data analysis tools.

Flexible hardware concept
KiBox2 employs a fully modular hardware concept consisting of data acquisition units, populated with signal conditioning modules. The data acquisition units have a 16 channel capacity and can be cascaded together to increase overall channel count to 64. All devices in a test environment can be used flexibly together, or separately. Signal conditioning modules can be moved easily from device to device with no restrictions.

Ready for the future
KiBox2 has been developed as a modular platform to support all necessary development tasks. Both hardware and software are flexible and extendable for addressing the needs of future powertrains. Alongside the continuous e-testing evolution, new modules include NVH (noise, vibration, and harshness) are in focus.

Measure, analyse and innovate future powertrains

Modern powertrains are now complex, multi-dimensional systems with various energy sources and propulsive elements. This creates measurement complexity and challenges for efficient development. KiBox2 supports the powertrain development workflow by allowing Engineers to tackle such systems with measurement speed and efficiency.

KiBox2 incorporates a sophisticated electric power analyser, specifically created for Engineers developing and integrating e-machine systems into their future powertrain concepts. Electrical power losses and flows can be measured and characterised with ease. All data is stored with high-fidelity and synchronously to allow efficient, offline processing and deeper analysis.

Complex powertrains need efficient workflows and tools
Electrical power analysis is new topic for many Powertrain Engineers. KiBox2 provides a streamlined user interface to facilitate fast measurement set-up, efficient data acquisition and storage, and features for advanced electrical signal analysis. This supports the Engineer to characterise electrical system losses, helping to understand where efficiencies can be improved in new energy powertrain system.

Accurate cycle detection and data handling
A precise determination of the calculation window within an electrical cycle in real time is key for correct digitally based power calculations. The KiBox2 high-performance hardware platform is optimized for the task and capable of accurate cycle detection under all required operating conditions down to a portion of an electrical cycle. All raw data are stored in an ASAM standard format (.mdf) and file converters are included for data exporting to other formats.

Optimised analysis for power calculations
The integrated formula library is included and contains all standard calculations for IEEE1459 analysis. All standard AC/DC power calculations are included, it also possible to appended these with user specific analytical formulas using the integrated, real-time formula compiler. All system measured data is synchronized and stored with the highest accuracy and fidelity for post or re-processing.

System accuracy, essential for the task
For electrical power analysis, uncertainty of measurements values means that ratios of these values, can produce large errors, making calculations unusable. The accuracy of the complete measuring chain is essential for a detailed power analysis. Base accuracy for the KiBox2 power analyzing system is optimised for the task, even for wide range, variable frequency applications encountered with traction drive systems.

Measurement safety and security for users
Measurement system interfaces must be easy to apply with the appropriate level of safety. In-vehicle access to critical signals can be challenging, High voltage AC/DC supplies are dangerous, indirect current measurement via clamps can be inaccurate. KiBox2 supports voltage input devices from various suppliers. The flexible VAQ modules can support industry standard current measurement solutions as well as wide-range direct differential voltage inputs.

Supporting the whole development process
The KiBox2 Power analyser is designed to be applied right across the development process - integration, calibration, verification and optimisation – Electrical power flows are essential for electrical energy consumption/usage, combining this with Kistler in-vehicle torque measurement solutions allows a detailed understanding of energy flows during real-time driving conditions.

Kistler service:
just as mobile and versatile as your KiBox2

Backed by a worldwide service network, Kistler offers customized services for your KiBox2.

Perfect calibration
Our calibration service ensures that your KiBox2 will operate accurately and reliably throughout its long service lifetime. If you so wish, we will carry out calibrations in the Kistler Tech Center nearest to you. Your benefits: efficient quality management and constantly high process reliability. Each calibration is documented with a certificate to confirm that your KiBox2 is in proper operating order and to guarantee traceability to national and international standards.

Comprehensive consulting & engineering Services
Our experts are on hand to assist you during every phase of powertrain analysis – either with highly specific tasks, or throughout the entire process.
Our range of services:
1. Test preparation and initial operation
2. Performing and optimizing measurements
3. Evaluation and on-the-job training
4. Development and implementation of customer specific computation algorithms (user formula)

Keep control of costs, quality and time
Our services will prevent any unpleasant surprises as regards costs and resources. Simply call on assistance from our measurement experts whenever you need it. Our experience and our holistic approach to developing solutions are your guarantee of highly efficient, goal-oriented powertrain analysis.

Worldwide presence
for our customers

Wherever vehicle and engine tests are carried out, Kistler is on hand to offer sensors and systems – backed up by a host of services that range from professional advice and support to calibration and spare parts across the globe.

● Sales Center
▲ Tech Center
◆ Tech Office
■ Production Center