imc

Productive Vehicle Testing
robust • compact • flexible

Efficient solutions for vehicle testing & driving dynamics

imc - productive testing

Reaching solutions faster

Increasing productivity in vehicle testing with imc

Productive vehicle testing means for us that our customers reach their goals faster and more efficiently. Our robust systems operate reliably during test drives, even in extremely harsh environments. Featuring black-box functionality, PC-independence, suitability for an extended temperature range and shock/vibration resistance – our systems are fully integrated and stand ready for road trials.

With a small form factor and high temperature resistance, systems such as the imc CANSAS*fit* are ideal for testing in demanding areas like in a vehicle's engine compartment. Thanks to the click mechanism, modules can be mechanically and electrically connected without any cabling – a feature that is shared with the imc CRONOS*flex* series, thus making it ideal for quick, dynamic installation and measuring.

Furthermore, our systems are able to precisely capture a wide range of signals received from virtually any type of sensor, have a tolerant power supply, come with convenient, simple connections and can synchronously capture field bus data, such as CAN, LIN or FlexRay. Due to the modular concepts of many of our systems, maximum signal quality can be preserved because distributed modules can be placed close to the sensor. The intelligent interaction with imc software allows for results in real time and provides remote functionalities as well as extensive analysis, visualization and report options.

The imc portfolio is perfectly complimented with proven telemetry and sensor technology solutions. Combining innovative wheel force transducers, steering effort sensors and modern telemetry systems with the modular measurement hardware and software, customers can test, optimize and produce their vehicles with the support of a consistent and integrated test and measurement chain. This makes measurements, analysis and documentation safer, less costly and more productive. In markets where accelerated development cycles and „time-to-market" are key concerns, this offers competitive advantages, not to be underestimated.

Mobile applications
- Endurance testing
- Climate testing
- Fatigue analysis
- Cold-start behavior
- Model verification in vehicle testing
- Brake tests
- Crash tests
- Road performance
- Driving dynamics
- Engine & powertrain testing
- Performance tests

ISO & standard testing
- Acceleration tests
- Fuel consumption measurements
- Noise & vibration testing
- Passenger safety
- Brake tests

Mobile system topologies

imc systems capture vehicle data and sensor information synchronously. Our products offer various interfaces for different software solutions and application systems.

OBD2   KWP   FlexRay

CAN   ECU   UDS

CCP   LIN   XCP

U   i ϑ

$\mu\varepsilon$ ICP   f

vid   dB

GPS
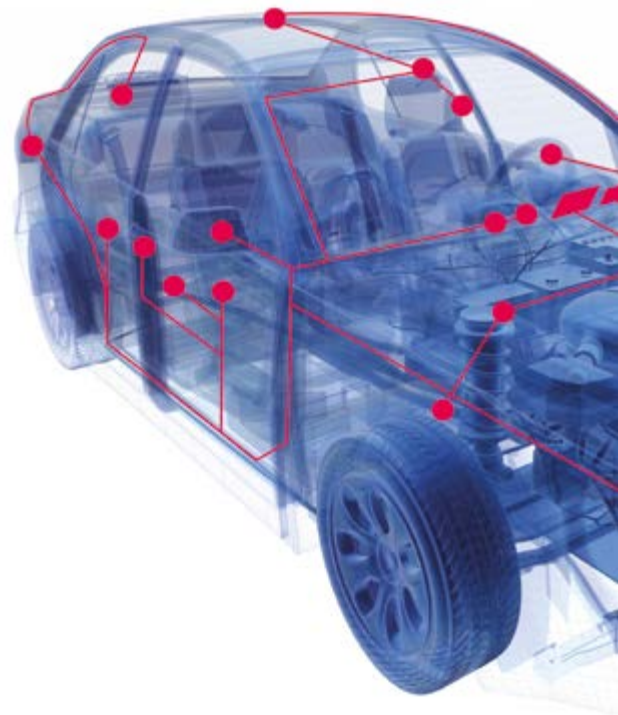
**test data cloud:
imc WEBDEVICES**

3G/4G

WiFi

CAN

XCPoE

Mess-PC

imc STUDIO
imc FAMOS
NI LabView
NI DIAdem
IPEmotion
CANape
INCA
...

imc systems for vehicle testing

Clickable measurement modules
imc CANSAS*fit*

- Compact measurement modules for voltage, current, temperature, strain, ICP, frequency
- Operation from -40° to +125° C
- IP65 protection rating, MIL STD-810F
- Attach modules without cables or tools (click mechanism)

imc CANSAS*flex*

- Universal measurement and I/O module for all relevant sensors and signals
- Simple integration via CAN interface
- Central or distributed installations
- Precise synchronization across multiple modules

Intelligent, clickable data logger
imc BUSDAQ*flex*

- Supports all common vehicle communication buses, such as CAN, LIN, FlexRay, J1939, ...
- Handles a variety of protocols, such as CCP, XCP, DiagOnCAN ...
- Autonomous with self-starting capability (wake-up on CAN)
- Low power consumption
- Operation from -40° bis +85°C
- Condensation allowed

Combination: imc BUSDAQ*flex* and imc CANSAS*flex* modules

Fast, modular and spatially-distributable measurement system
imc CRONOS*flex*

- Flexible modularity through frameless expansion and click mechanism
- Up to 2000 kS/s per system and up to 100 kS/s per channel
- Supports nearly every signal and sensor type
- Synchronous acquisition from one up to thousands of channels
- For spatially-distributed or central installations
- Simultaneous recording of analog, digital, and vehicle bus data
- Integrated real time analysis

Compact measurement systems
imc C-SERIES

- Portable measurement device for mobile testing
- Cost-effective solution for measurement require-
  ments with 4 to 32 channels
- Synchronous acquisition of analog, digital, and
  CAN bus data
- Sampling rate of 400 kS/s per system

imc CRONOS-XT

- Extremely robust and modular
- Shock resistant: MIL STD810F
- IP67 protection rating
- Temperature range: -40°C to +85°C
- Condensation allowed
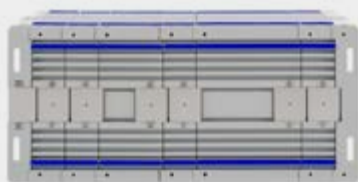
Software
imc STUDIO

- Measurement hardware configuration & management
- Create custom GUIs
- Measurement data visualization
- Database supported adminstration of measurement
  data
- Automate testing workflows

imc FAMOS

- Powerful measurement data analysis &
  documentation
- Comprehensive analysis functions
- Create multi-layer macros
- Create custom GUIs
- Handles large amounts of data

imc WAVE

- Software for sound & vibration measurements
  according to industrial standards
- Sound level meter
- FFT-, octave & 1/3-octave analysis
- Structural and modal analysis
- Order tracking

Service

Use our product and application know-how

Test & measurement support

- Technical support with application and device issues
- Effective use of complex product features
- Remote maintenance
- On-site service and commissioning
- Methodical and systematic
- Data conversion and evaluation algorithms
- Automation of operation, analysis, documentation and data management
- Analysis sequences
- Test stand automation and control schemes

Increase productivity

imc ACADEMY

- Product and application training
- Seminars and workshops
- Entry-level training for test and measurement
- Advanced training for developers
- Train-the-Trainer programs

Rent our solution expertise

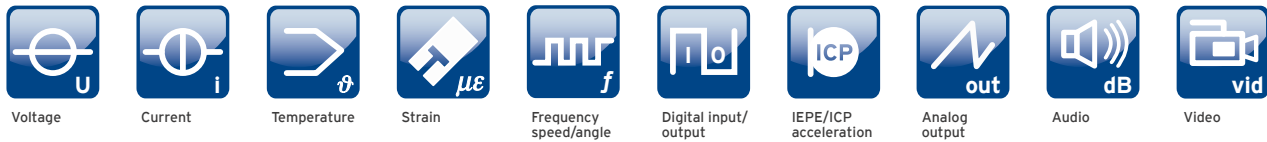**Device rental and personnel contracting**

- Use of modular measurement systems
- Consultancy regarding configuration and connections
- Accompanying support or contracted testing by our specialists
- Signal analysis and test reports
- Or have everything from a single source: Contracted testing with sensors & measurement devices incl. professional evaluations and documentation

Protect your investment

Calibration, maintenance, repairs and updates

- Strategies for system maintenance
- Calibration and adjustments
- System inspection and repairs
- System updates
- Express and on-site service

Single source-solutions for mobile testing

Voltage	Current	Temperature	Strain	Frequency speed/angle	Digital input/ output	IEPE/ICP acceleration	Analog output	Audio	Video

imc hardware
the right equipment for every need

Modular expandable systems for centralised & distributed applications

Compact, rugged & mobile systems

Video- /Audio- integration

Complete telemetry solutions

measurement and data transfer software
intuitive and efficient

One software platform for the entire measurement cycle
imc STUDIO

Remote monitoring & automatic data transfer
imc LINK/
imc WEBDEVICES

Real time data analysis and data reduction for fast results

NVH analysis
imc WAVE

Software for analysis and data storage
fast evaluation of large data amounts

Central storage and management of measurement and test data - including metadata with imc SEARCH

Evaluate, analyze, visualize & report with imc FAMOS

Hundreds of evaluation functions for productive testing

Connection to external databases, such as ORACLE or MS and ODS server

Vehicle testing requirements		imc solution						
		imc CANSAS*fit*	imc CANSAS*flex*	imc BUSDAQ*flex*	imc CRONOS*flex*	imc C-SERIES	imc CRONOS-XT	D^x Telemetry
Device design								
Robust	outdoor, harsh environments	✓	◊	◊	◊	◊	✓	✓
Miniature	vehicle instrumentation	✓		◊		◊		✓
Flexible expansion	quickly changing test envionments	✓	✓	✓	✓		✓	✓
Click mechanism	tool-free, mechanically and electrically	✓	✓	✓	✓		✓	
Environmental suitability								
IP65/67 protection	sealed, water-proof	✓					✓	
Condensation allowed		✓	✓	✓	✓	✓	✓	✓
-40°C to +85°C	extended temperature range	✓	✓	✓	✓	✓	✓	✓
-40°C to +125°C	extended high-temperature range	✓						✓
MIL 810F	shock and vibration resistant	✓	◊	◊	◊	◊	✓	◊
Connectivity								
Ethernet	configuration and data transfer			✓	✓	✓	✓	◊
WLAN	wireless in mobile environments			✓	✓	✓	✓	
GSM/LTE	mobile connectivity, globally			✓	✓	✓	✓	
GPS	geo position data and time synchronisation			✓	✓	✓	✓	
Handheld display	panel operation, e.g. by driver			✓	✓	✓	✓	◊
Internal storage	robust flash media (SD, CF, SSD)			✓	✓	✓	✓	
Remote data transfer	fleet test, web server, imc LINK etc.			✓	✓	✓	✓	
Analog sensors								
analog signals	temperature, voltage, 20mA, strain	✓	✓		✓	✓	✓	✓
RPM	pulse counter, incremental encoder	✓	✓		✓	✓	✓	
HV	high voltage environment (hybrid, eMobility)		✓		✓			
Acoustics	acceleration and sound for NVH	◊			✓	✓	✓	
Automotive data source								
CAN		✓	✓	✓	✓	✓	✓	✓
LIN				✓	✓		✓	
FlexRay				✓	✓		✓	
XCPoE				✓	✓		✓	
ECU protocols	OBD-2, CCP, KWP2000, XCP, UDS			✓	✓	✓	✓	
WFT interface	CAEMAX, Kistler RoaDyn			✓	✓			✓
Steering sensor	CAEMAX: steering force and angle							✓
Extensions								
Video	camera integration via imc STUDIO			✓	✓	✓	✓	
HiL	real time simulation with MATLAB Simulink				✓			
SENT	SENT gateway as data source		✓					
Operation and supply								
Autarkic operation	autonomous without PC	✓	✓	✓	✓	✓	✓	✓
Data security	upon power failure and cold start			✓	✓	✓	✓	
USV	buffered battery operation				✓	✓	✓	
Li-Ion	long-term UPS				✓		✓	
On-board power supply	Wide range DC 9-36V for all electrical systems	✓	✓	✓	✓	✓	✓	✓
Application area								
Mobile	vehicle testing: on-road and off-road	✓	✓	✓	◊	✓	✓	✓
Fleet testing	inexpensive systems for mass applications	✓	✓	✓		✓	◊	✓
Vehicle development	flexible, powerful systems for RTD				✓		✓	

Legend: ✓ ideally suited, ◊ well suited

In Practice

Fleet testing

When conducting fleet tests, the vehicles are always at different places. Measurement data is recorded via CAN, LIN or FlexRay with imc BUSDAQ*flex* multi-bus data logger. When the car is parked, imc BUSDAQ*flex* goes into sleep-mode. By means of "wake up on CAN", the measurement start is triggered, for example, by opening of the vehicle's door. Within 200 ms, the system begins its preconfigured measurement. At the same time, imc BUSDAQ*flex* automatically connects via the UMTS network with the internet. Access to the vehicle's measurement device is now possible from a PC or the imc internet platform. Limit violations are reported automatically and a complete series of measurements can be transmitted to the imc cloud or office PC. Likewise, changing the configuration remotely is also possible.

Endurance testing at the track

In order to bring new vehicle models into production quicker, testing and development need to work hand in hand. Early on in the development stage, components must undergo testing in extreme environments. Gradually, more and more prototypes are build to parallelize the testing efforts, run a higher number of tests and obtain more statistical data. Whereas in the early stages of development, functional testing on a few prototypes is in the foreground, later in the process, the focus shifts towards aspects of endurance and climate conditions. Entire fleets can be equipped for stress testing (material fatigue). These types of endurance testing can last anywhere from several hours to several months. Advancements and improvements during the different test cycles will lead to changes in the testing requirements placed upon the measurement modules. Compact measurement modules, such as imc CANSAS*fit* or loggers, such as imc BUSDAQ, are ideal for these demands – and if the environmental conditions are extreme, then imc CRONOS-XT is well suited.

Climate testing

Do you need to perform tests during the middle of the Swedish winter or perhaps in a climate chamber? No problem with imc systems: imc CRONOS-XT is a modular, ultra-robust data aquisition system designed for harsh environments. It meets IP65 and MIL STD-810F, one of the highest standards for temperature, dirt and shock resistance. Signal conditioning, AD conversion, online processing and data storage are an integral part of the measurement system. Thus, imc CRONOS-XT is ideal for use with experimental measurement requirements, endurance testing or monitoring, in vehicles or at remote locations where standard equipment would normally fail. imc CRONOS-XT is especially productive when used in conjunction with the imc STUDIO software platform. System setups do not need to be manually programmed, but can instead be configured on a well guided GUI. This saves time and increases operational safety.

Measurements under the hood

In cramped areas, such as under the hood, high temperatures can prevail. In applications like this, the new, clickable imc CANSAS*fit* series is ideal – the modules operate reliably from -40° to +125° C and because of their small size, they can be placed almost anywhere. The modules support direct connection to all typical sensors and signals such as voltage, current, temperature, RPM, displacement, velocity, strain and acceleration. The digitized signals are output as CAN messages and can be read or recorded by any measurement, automation or control system with a CAN interface. These modules are perfectly complemented by an imc data logger – for example, imc BUSDAQ. These loggers are ideally suited for use in development and test of ECUs, where they provide acquisition and real-time processing of measurement information from vehicle and field buses.

Cost-effective measurement device for mobile testing

Whether on a motorcycle, passenger car or harvester machine – imc C-SERIES is perfect for performing vehicle testing thanks to its small size, signal conditioning, GPS data acquisition and wide input voltage range for supply (incl. temporary UPS). Another advantage is the possibility of autonomous operation without a PC. With 4-32 analog inputs for all typical sensors and an integrated CAN interface with optional support for ECU communication, all relevant vehicle data can be synchronously acquired with a single system. In addition, the systems can be equipped with a UTMS modem that establishes an automatic connection with the internet. Via the imc LINK remote monitoring software for PCs or the imc WEBDEVICES remote monitoring internet platform, status information can be queried and measurement data can be transmitted.

Structural durability of rotating components

Regarding today's measurement requirements in the vehicle industry, the focus has grown to include testing on the various sub-assemblies which are made up of a variety of rotating components. The trend of taking a holistic approach toward these vehicle components presents new challenges when it comes to telemetric signal transmission. With D^x telemetry, the imc partner CAEMAX, offers a solution for simultaneous acquisition from multiple rotating components. Up to four transmitter units can be tied into a single receiver. Although these four modules may be located on different rotating components, they are all centrally controlled and synchronized. The receiver unit synchronizes and controls the individual transmitter units and combines the measurement data to a single data stream. Using sequential transmission allows multiple modules to use the same radio frequency channel without interference.

Brake testing

When performing brake tests under wet conditions, the vehicle is driven at high speeds on a wet track, for example, and then must brake to a complete stop. Of particular interest are the vehicle and wheel dynamics during ABS wet braking.

With a compact measurement device installed, such as imc BUSDAQ*flex* or imc C-SERIES, the braking performance can be recorded. Together with the recorded values of the velocity (x-, y- and z-axis) from an external optical system and a triaxial acceleration sensor, as well as the data from the vehicle bus, the measurement data are sent for evaluation. The proven imc FAMOS signal analysis software is ideally tailored to meet the needs of engineers by providing data visualization at the push of a button, data source management, a comprehensive range of analysis functions and convenient report generation.

Driving dynamics testing

Combining Wheel Force Transducers (WFTs) and steering sensors from CAEMAX with imc measurement systems to acquire a variety of physical forces allows for complex, high-precision measurements of vehicle dynamics. For instance, all forces and torques on the vehicle's wheels can be measured together with driving dynamic values like slip and camber angles. The new WFT-CX can be used on anything from small cars (minimum wheel size: 14") up to larger SUVs and light trucks (maximum hub diameter: 5.5"). In addition to their water-proof design, the units are shock resistant up to 50g, thus enabling testing over rough terrain and speed bumps. Along with data from wheel and chassis movement, CAEMAX and imc offer solutions for comprehensive analysis of vehicle dynamics.

Model verification in vehicle testing

In order to analyze the efficiency of electric vehicles, field trials and subsequent model verifications are necessary. Thus, e-vehicles can be equipped with imc BUS-DAQ devices to acquire the vehicle's overall energy requirements. The project team records the electrical and mechanical parameters, as well as the travel route via GPS, thus enabling an assessment of the route profile to be made. In addition, data from the charging stations are acquired and saved in order to assess the performance of the energy storage system. Automated analyses with imc systems on individual vehicles contribute to a rapid assessment of driving profiles. The data recorded on the test track, among others, are fed into a Matlab Simulink model. Thus, with the help of an imc CRONOS*compact*, with an integrated HiL processing platform it is possible to simulate even extreme environmental and operational conditions and to test the vehicle behavior, including individual components, on the test stand.

Optimizing vehicle interior acoustics

When buying a new car, most customers consider interior noise comfort an important factor. Therefore, vehicle manufacturers must perform a comprehensive series of tests and measurements – both on the test bench and on the road. One such test, for example, is to drive the vehicle under full and partial load. In addition to the comfort-relevant measurement data, operational status information is acquired via CAN or analog sensors and correlated to the acoustics performance.

With imc WAVE, we offer a powerful software platform for noise and vibration analysis. Various analyzers cover a wide range of applications: from acoustical inspections during road tests, structural analyses on the test bench, up to vibration testing.

imc Test & Measurement GmbH

Voltastraße 5
13355 Berlin
Germany

Tel.: +49 (0)30 - 46 70 90 0
Fax: +49 (0)30 - 463 15 76
hotline@imc-tm.de
www.imc-tm.com