imc

imc electric motor testing
quick • precise • reliable

Turnkey test stands for E-motors & electromechanical drive components

imc – productive testing

Electric motor testing – our expertise

- Development test stands & end-of-line test stands
  - Testing of all common E-motor sizes from 100mW – 100kW
  - Testing of complex E-drive components & actuators
  - Testing according to standards & customer requirements
  - Simulation of hardware & software components (imc HiL)
- Integration in production & administration
- Comprehensive services: consulting, conception, implementation, calibration, maintenance & training

imc electric motor testing

Test stand technology & solutions from a single source

Electric motors are ubiquitous throughout the automotive, machinery and aerospace industries. With rising demands for comfort and safety, the number of electric motors is also increasing. Testing these motors for functionality and reliability is crucial before they are installed in hard to reach places.

For 25 years, imc has been offering turnkey test stands for all types of electric motors, as well as solutions for testing components such as rotors, stators, electric drives and actuators.

imc covers the entire spectrum of E-motor testing and provides complete solutions from a single source.

We offer expert consultation, design and implementation of test stands to meet any requirement, including the development of testing strategies and custom applications. Additional imc services such as calibrations, training and even contracted testing help to make your imc solution a sound investment for today, as well as for the future.

Test objects

• EC- / BLDC-motors
• DC-motors
• AC-motors
• Components

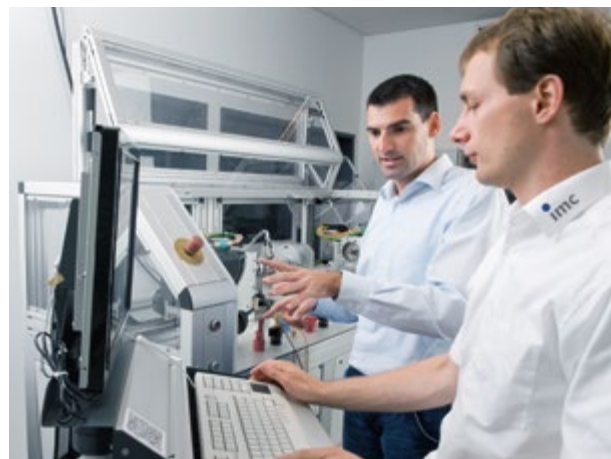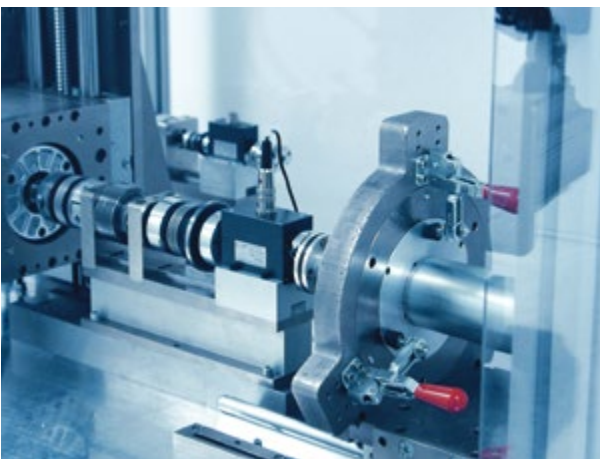|					
Voltage	Current	Torque	RPM	Temperature	Strain gauge
IEPE/ICP acceleration	Frequency speed/angle	Acoustics	Vibration	Digital input/ output	Analog output

Test methods

imc offers both a conventional method for testing electric motors, as well as the model-based parameter identification method (PI). These methods complement each other in their respective fields of application.

Conventional motor testing

imc test stands using the conventional testing method are suitable for a variety of tasks. They feature extensive measurement functionality for diverse and constantly changing electric motor testing requirements.

A controlled, 4-quadrant actuator drives the test unit at a particular speed and load profile. By this means, the motor's mechanical power can be determined by measuring torque and RPM.

The imc test stand can be perfectly adapted to various motor sizes using adjustable fixtures and torque sensors with an appropriate input range. This makes it possible to determine all mechanical, electrical and thermal properties, overload capacity and such technical specs as the efficiency and power factors.

Motor testing with the PI method

Many electric motors must be fully inspected and tested at the end of the production process. With the parameter identification method, imc offers a turn-key, model-based solution that requires no mechanical coupling of the test object – the cost of connection and alignment can be omitted completely.

This method of evaluating electric motors makes intelligent use of knowledge about the structure of the motor. This can be used to create a model for the electrical and mechanical part of any motor and employed during testing.

The motor voltage in the PI method represents the input quantity and the motor current the output quantity of the model. Both of these quantities can be simply and directly measured during dynamic control and allow all model parameters – e.g., motor resistance, etc. – to be determined. The static and dynamic parameters comprise a test result which allows a complete assessment of the test object. Comparison with anticipated set points forms a qualified method for end-of-line testing.

Noise and vibration analysis completes the motor testing in areas where electrical and mechanical parameters are difficult to measure.

A variety of special tests, such as temperature monitoring, isolation strength or rotational testing can be implemented into all test stand methods, whether standard or custom.

Increase productivity with our test stand solutions

Quick testing of electric motors
- Fully-automated testing
- Model-based PI method saves time by eliminating the mechanical motor coupling
- Integrated testing concepts – immediate test results can be incorporated to improve and speed up further testing

Reduce testing costs per motor
- High reproducibility of measurements – reduces additional testing
- Accelerated processing times
- Long-life, durable test stands (ROI) and easily adapted to new conditions

Flexibility on the test stand
- Multifunctional test stands can solve a wide range of tasks
- Flexible mechanical design
- Easily customizable, modular hardware and software components

Efficient & customizable software
- Same software for a wide range of applications
- Open interfaces allow individual expansion
- Integration of user-specific expansions
- Interfaces to ERP and MES systems
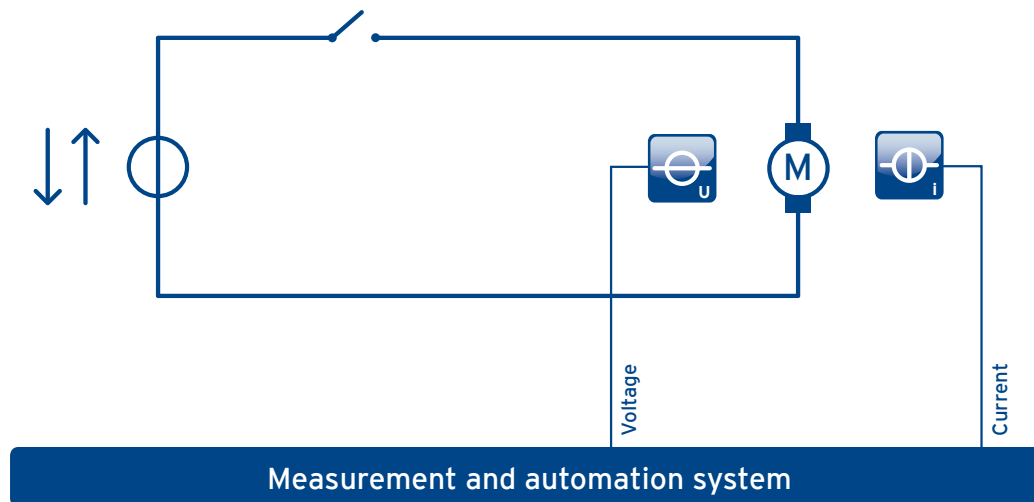
Expert technical solutions
- 25 years of experience - sound technical project consulting & execution
- Interdisciplinary team with strengths in the areas of electrical, mechanical, acoustic and vehicle technologies
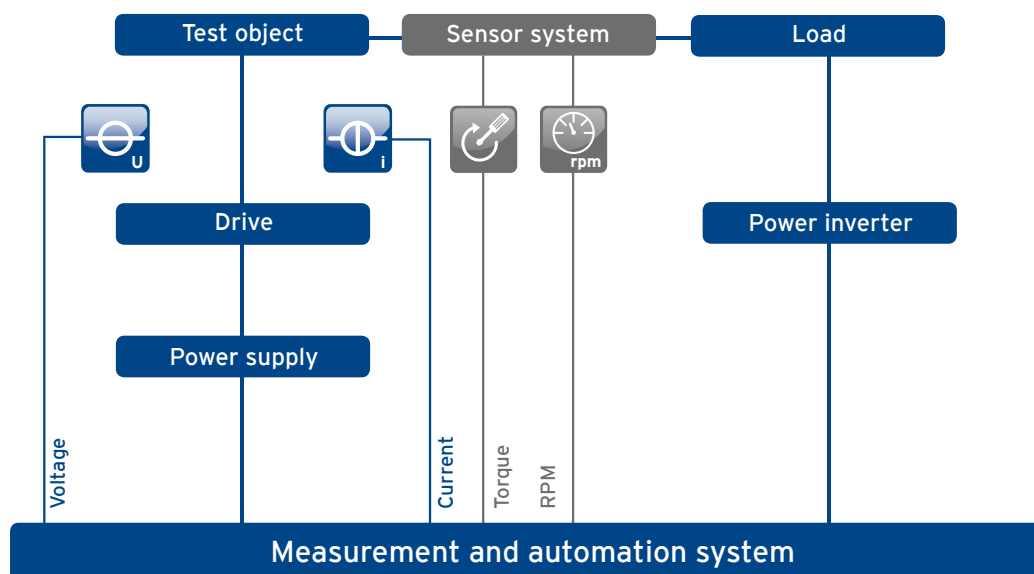- Creating customer-specific test strategies

Service & training
- Turnkey delivery to customers & after-sales service
- Training for electric motor testing
- Contract measurements
- Maintenance and further development test stands
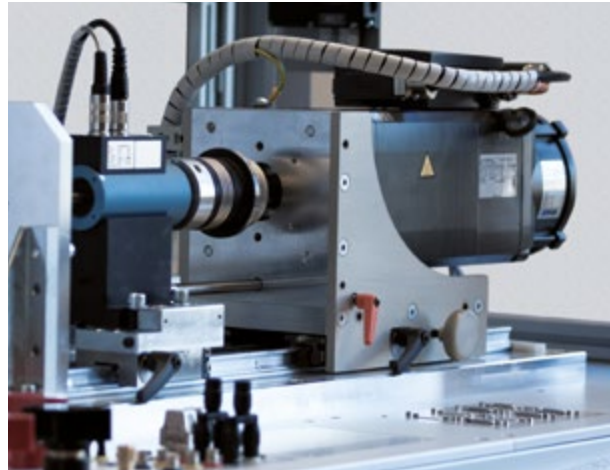
Parameter identification method

Voltage

Current

Measurement and automation system

Conventional E-motor testing

Test object	Sensor system	Load

Drive

Power inverter

Power supply

Voltage

Current

Torque

RPM

Measurement and automation system

In Practice

Shorter development times with imc HiL

With product development cycles that are constantly being reduced, the simulation of components in development test stands is key to becoming more efficient. imc HiL provides a solution by offering data acquisition, control and simulation in a single system. Using MATLAB/Simulink, imc HiL integrates simulated components or environmental conditions directly into the measurement system and test procedure. Embedded directly in a measurement system processor, the models are carried out in real time – synchronous to the measured variables.

E-motor testing in seconds

Is it possible to test 20,000 motors in a 24 hour period on a single test stand while maintaining the highest accuracy? Yes, since 1993! Using parameter identification test stands from imc, motor testing has become much more efficient. When it comes to mass production, end-of-line comprehensive motor diagnostics is not the only thing to consider – time efficiency is also critical. imc offers turnkey test solutions that provide both high testing speeds (cycle times), as well as a complete characterization of the motor.

Flexibility – the answer to changing tasks

imc test stands are distinguished both by the modularity of the hardware, as well as by the adaptability of the software. This flexibility allows for quick and effortless changes to be made to the set up and avoids unwanted downtime of the test stand.

Acquisition of different measurement variables is also not a problem due to the interchangeability of the amplifier modules. Because of its interface capability, even third-party systems can be integrated.

imc motor diagnostic software

A test stand is always only as good as its operating software. This powerful and adaptable program is also clear and user-friendly to make the evaluation of test data quick and easy. Motor diagnostic software from imc enables 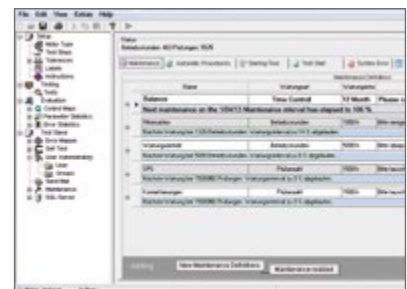automated monitoring with error detection – even alerting the test manager by sending notifications to a cell phone, an automated e-mail or allowing access through remote computers. It also offers convenient functions for data administration, output and analysis.
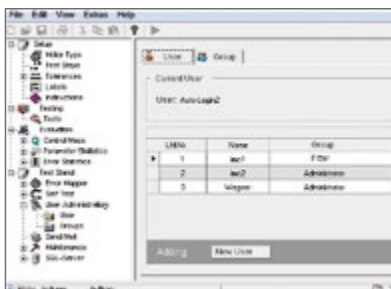
User access rights & administration
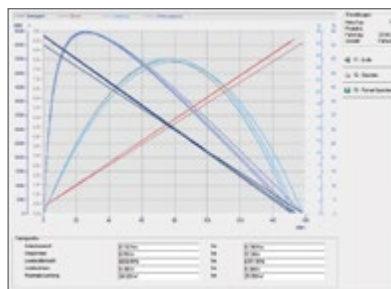
Graphical analysis capabilities

Maintenance control and notification

Software components

Measuring and calibrating

- **Calibration**
  Tracing calibrations to measurement standards

- **Network client**
  Access to test stations from remote workplaces without interrupting the test procedure; configuration of testing instructions and evaluation of results

- **imc@mail / SMS manager**
  Automatically sends freely configured e-mail/SMS in response to various events (error occurrence, task completion, etc.)

- **Random production**
  Sequential testing of various motor types in fully-automated production lines

- **imc maintenance manager**
  Protecting your investment from deterioration
  - at regular intervals
  - based on test run count
  - based on operating hours

Monitoring and control

- **Maintenance control and notification**
  Freely configurable module for defining and monitoring maintenance work

- **Error mapping**
  Freely configurable error numbers and texts with monitoring of a maximum permitted number of consecutively occurring errors

- **Self-monitoring**
  Integrated self-monitoring of the system, with error diagnostics

- **Access control**
  Administration of users with varying access authorization

- **Remote maintenance**
  Software updates and online help

- **Traceability**
  Reconstruction of every measurement's test setup

- **imc FAMOS**
  Simple computation of derived quantities from physical quantities

Saving and analysis

- **Storage of inspection data, Linkage to MES system**
  Adjustable saving interval of test results and external storage of data on an SQL-server with data selection (statistics or raw data); data can be read back from the SQL-server on the basis of a specified serial number

- **Administration**
  Automatic or manual administration of jobs and serial-numbers

- **Evaluation**
  Wide variety of graphical and tabular analysis options (e.g., Pareto diagrams, inspection charts, computation of statistical profiles)

- **Label printing or laser marker**
  Linkage to a variety of label-printers, with administration of test-object-specific labels
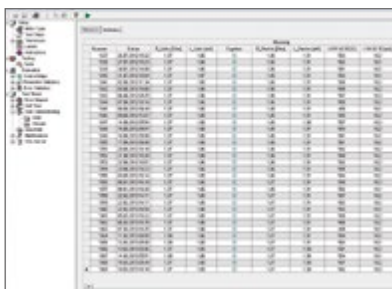
Automated monitoring with error diagnostics
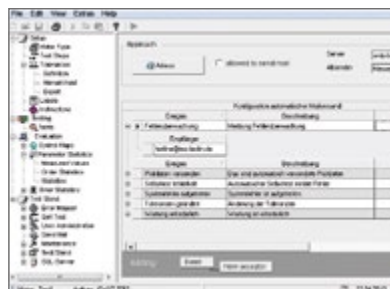

imc@mail / SMS manager
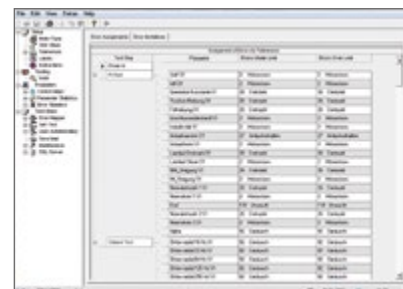
Configurable error mapping

imc E-motor test stand overview

Test stand type	Development test stand	End-of-line test stand	Endurance test stand
Test objects			
E-motors			
DC-motors (classic / PI)	● / ○	● / ●	● / ◆
EC-motors (classic / PI)	● / ○	● / ●	● / ◆
BLDC-motors (classic / PI)	● / ○	● / ●	● / ◆
AC-motors (classic / PI)	● / ○	● / ●	● / ◆
Universal motors (classic / PI)	● / ○	● / ◆	● / ◆
Components			
Rotor	●	●	◆
Stator	●	●	◆
E-drives			
Servo motors	●	●	●
Geared motors	●	●	●
Pumps, compressors and other aggregates	●	●	●
Electric power units	●	●	●
X-by-wire components	●	●	●
Electromechanical actuators	●	●	●
Electric powertrains	●	●	●
Load type / range			
Without load machine (at idling speed / PI)	◆	● / ●	●
One active load machine	●	●	●
Two active load machines	●	○	●
Load range			
0.1 W … 100 W (classic / PI)	●	● / ●	●
100 W … 1000 W (classic / PI)	●	● / ●	●
1 kW … 10 kW (classic / PI)	●	● / ●	●
10 kW … 100 kW (classic / PI)	●	● / ◆	●
Costumer specific (classic / PI)	●	● / ●	●
Test procedures			
Electromechanical testing	●	●	●
Fatigue testing	●	●	●
Vibration / balance testing	●	○	○
Dimension check (e.g., bearing clearance)	●	○	◆
Temperature monitoring	●	○	●
Check of the rotational direction	●	○	◆
Isolation testing	●	○	◆
Type testing (VDE 0530 / DIN EN 60034-xx)	●	○	◆
Precision measurements			
Voltage (classic / PI)	● / ●	● / ●	● / ◆
Current (classic / PI)	● / ●	● / ●	● / ◆
Torque (classic / PI)	● / ○	● / ◆	● / ◆
Speed, RPM (classic / PI)	● / ○	● / ◆	● / ◆
Temperature (classic / PI)	○	○	●
Direction (classic / PI)	○	○	○
Vibration (classic / PI)	○	○	○
Acoustic (classic / PI)	○	○	○
Isolation (classic / PI)	○	○	◆

Test stand type	Development test stand	End-of-line test stand	Endurance test stand
Mechanical design / adaptation			
Stand alone - measurement & control system only (no mechanical components)	●	●	●
Stand alone complete (test cell / 19" cabinet)	●	●	●
Stand alone complete (test stand type)	●	●	●
Stand alone - with enclosed climatic chamber	●	●	●
In-line test stand (coupled to production line)	●	●	●
Environmental conditions			
Standard conditions	●	●	●
Pre-set climatic conditions	○	○	○
Controlled climatic conditions	○	◆	○
Use & operation			
Manual	●	○	●
Automatic (standard)	○	●	○
Automatic (complex test sequence)	○	◆	○
Statistical learning, machine learning	◆	○	◆
Test results / administration			
Manual administration / setup	●	●	●
Administration / setup by production planning and control system (MES, ERP...)	○	●	○
Automatic data storage	●	●	●
SQL-Interface / database connection	○	○	○
Automatic data storage	○	○	○
Service manager	○	○	○
E-mail manager	○	○	○
Reporting / statistics	○	○	○

Facts & Feature

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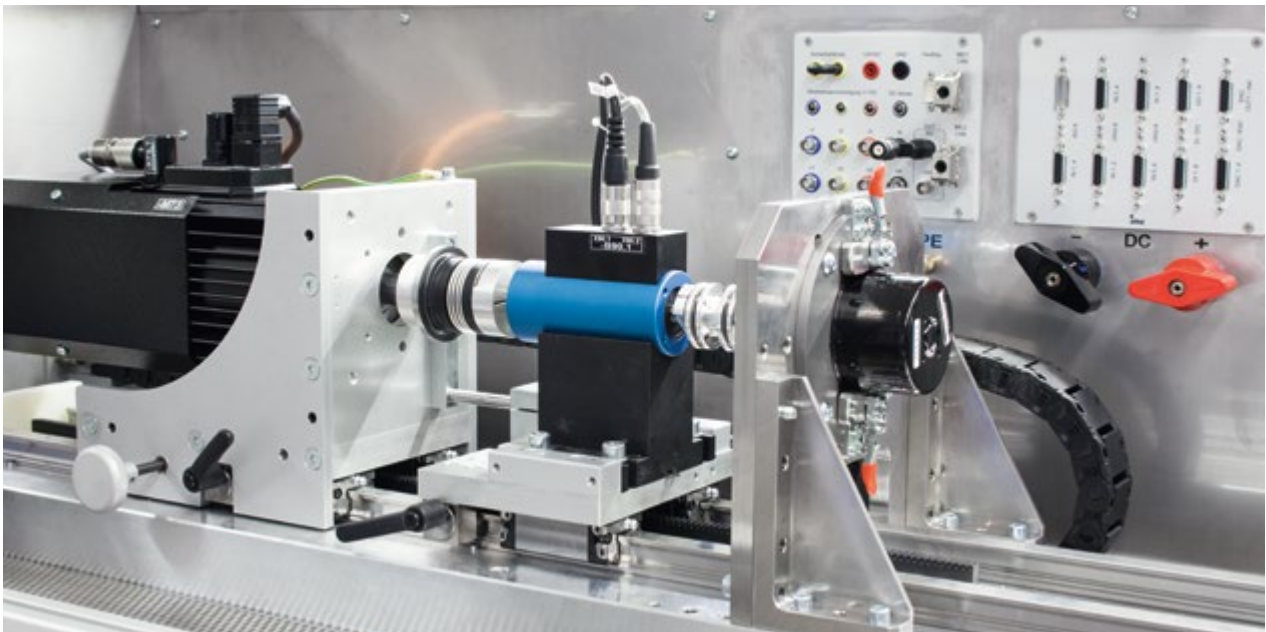
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