Integrated test & measurement at TRUMPF

Application notes: imc measurement technology used on TRUMPF sheet metal machinery

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As a world leader in the field of machine tools and industrial laser systems, optimization through continuous testing processes plays a crucial role at the TRUMPF Group. The constant development of machinery, improving power consumption and achieving higher speeds with absolute precision requires testing with the most advanced tools available. Since 2004, TRUMPF has relied on integrated solutions from imc Meßsysteme GmbH.

Surprising figures

The innovative strength and confidence in engineering is reflected in the amounts invested: according to the industry association VDMA (German Engineering Federation), German engineering firms spend more than 13 billion Euro for innovation expenditures annually, including about 5 billion Euro for research and development. Around 25% of all engineering patents filed worldwide are held by German companies.

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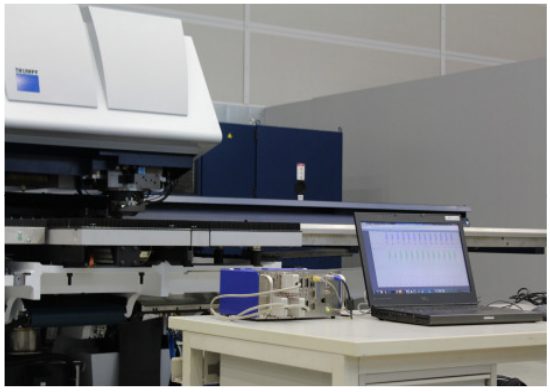
The TRUMPF Group, founded in 1923, holds a prominent position with around 60 subsidiaries, and is one of the largest suppliers of machine tools on the international stage. In the field of industrial lasers and laser systems, the company is a global market and technology leader.

More productivity at TRUMPF with imc measurement solutions

Reducing costs, increasing productivity and improving quality – one important key to achieving these goals at TRUMPF is an integrated test and measurement concept. Since 2004, imc has been a proven and reliable partner when it comes to providing efficient measurement solutions: from project planning through the finished reports, all the way to service and training concepts.

Whether creating the fender of a Harley Davidson, ultra-lightweight glasses, the radiator grill of a luxury sedan or a room divider – although these things seem very different at first, they all have one thing in common: precision fabricated sheet metal components. The TRUMPF customers who manufacture these components have been relying on the performance of their machine tools for years.

However, precision is only one aspect that needs to be met throughout the manufacturing process. How much a sheet metal part should cost needs to be known at the beginning of a design. In addition to the material cost, the manufacturing processes and the performance of the machines are critical. Therefore, numerous tests are performed during the development process to ensure they are performing within acceptable tolerances and are also conducted during the running operations as well.



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Test & measurement requirements from TRUMPF:

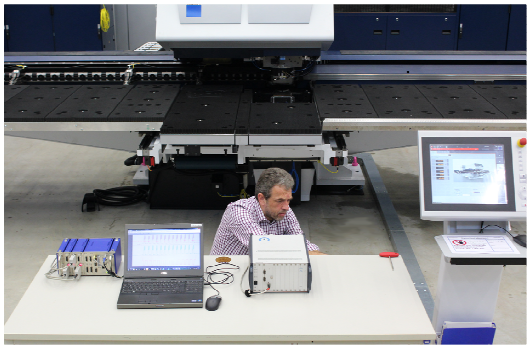
- Modular universal measuring systems, whose amplifiers can be quickly and easily added or replaced, depending on the measurement task
- Signal conditioning for a variety of sensor types, from static up to highly dynamic measurements
- Integrated hardware and software concepts: from device software and

configuration of the measurement system and automation processes, up to the analysis software that generates finished reports

- Synchronous acquisition of analog and digital quantities / internal machine process quantities can be measured synchronously with physical quantities
- Reactionless measurements on machine-specific busses: the machines are not to be influenced by the measurement (e.g., “spying” on the PROFIBUS)
- Recording of force and displacement values that can be displayed on an x-y plot
- Real-time calculations performed in the measurement device
- Development of a special connector for adapting current signals (11µA) from precision distance signal generators
- Longevity of the measurement systems – the measurement devices used by TRUMPF will outlast several generations of PCs. These devices are used both as PC-controlled measurement systems, as well as in stand-alone operation. Data storage occurs directly in the device and/or the PC
- To provide worldwide service on machines during operation, small and lightweight universal measurement devices are needed

Types of testing:

- Tests as part of the development of new machines
- Standard machine test & measurement
- Acceptance testing / type testing
- Quality assurance testing
- Testing in the context of service and repairs to machinery



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The flexible and universal powerhouse: imc CRONOS*flex*

In 2004, before TRUMPF had decided to go with imc measurement equipment, a separate device was being used for each variable that had to be measured: e.g., recorder, oscilloscope, multimeter, precision distance measuring devices and others. With a goal of increasing efficiency and optimizing the processes, all of these separate functions should be bundled into one unit – and at the same time, a high degree of flexibility was required, so that diverse and changing measurement tasks can be handled synchronously with a single system.
The obvious solution to this challenge:
imc CRONOS*flex.*

When it all “clicks” together

imc CRONOS*flex*: Click mechanism ensures flexibility

With its network-based, modular system architecture, the imc CRONOS*flex* offers TRUMPF an integrated, modular system that gives users an unprecedented level of flexibility in the composition of the measurement system. The system requires no rack or frame. Both the base unit and the modular measurement modules (amplifiers or conditioners) have independent housings. These can be used either connected by a robust click-mechanism to easily create an expansive system, or, alternatively, spatially distributed over a standard network cable. Here, up to 100m between the individual modules is possible.

imc CRONOS*flex* provides an aggregate sampling rate up to 2 MSamples/sec and individual channel rates of 100 kSamples/sec over the entire frequency range of physical measurements. Measurement modules are available for all standard signals and sensors.

Analog channels and PROFIBUS data can already be processed online and then further analyzed during the measurement – as opposed to reserving the analysis for a later, separate process step. It takes place synchronously – simultaneously available and visualized with the primary measurement data and consistently and uniformly managed.

The acquisition of internal machine process variables is an important aspect for TRUMPF machine tools – for example, when individual components need to be improved or the internal machine functions should be better coordinated with each other. Due to the TRUMPF master-slave topology within the machine components, the ability for reactionless measuring and monitoring is an important advantage in imc devices because the machines are not influenced by the measurement.

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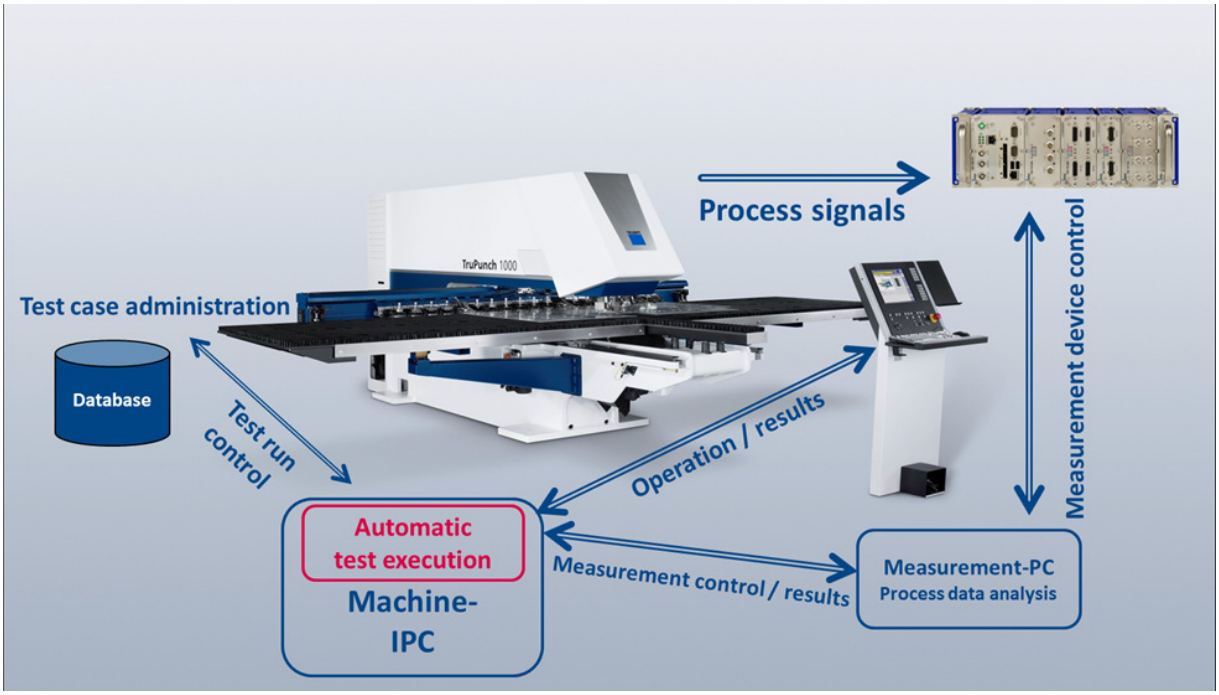
Smooth interaction with the imc STUDIO software platform

The interaction between software and hardware components of the measurement systems plays a key role when it comes to the most efficient way to obtain results. Thus, the imc STUDIO measurement software provides clear and comfortable handling. Even large channel counts are clearly displayed and are available to be viewed and evaluated online by multiple users simultaneously. Furthermore, in imc STUDIO, channels from different measurement locations can be sorted and displayed according to measurement task.

The imc STUDIO Panel page is a multifaceted tool that allows for user-defined displays of data during the measurement. For example, the direct evaluation of the measurement with the aid of cursors and markers in the imc curve window allows immediate viewing and analyzing of the measurement data. Commenting on events during the measurement can be made by text and voice input and can be synchronously assigned to the measured data.

Automated function tests



The imc PANEL

Configuring customized user interfaces quickly and easily

The imc Panel component of the imc STUDIO package combines comprehensive functionality with an easily customizable user interface – without the burden of complex programming. Per drag & drop, complete interactive user interfaces, the creation of monitoring screens and report templates can all be realized within minutes. And just as fast, video and sound information can easily be integrated and synchronized with the measurement data.

Save time with automated sequences

With imc STUDIO there is a simple way to automate the same test sequences. The integrated sequencer allows single, recurring measurements and evaluation steps to be combined together into a Macro. Processes like "Load configuration", "Start measurement", "Analyze data" and "Create report" can be just as easily defined as a complex multi-page user guide.

Furthermore, in addition to saving development and test time because of the automatic operation of all of the measurement and evaluation steps, the risk of errors occurring due to manual operation is also minimized.

A unified format

In search of a unified data format, TRUMPF has turned to imc and has written the machine's internal data, among other things, in the standard imc data format. This ensures that data from different machines and measurement data from the measurement devices can be evaluated and linked together without using time-consuming conversions. This decision saves time and minimizes problems of interpretation in the evaluation of all information from various sources. For recurring special data formats, appropriate import filters for the imc FAMOS analysis software were created.

Service & training

In addition to extensive software training on the imc STUDIO device software and the imc FAMOS analysis software, TRUMPF also has appreciated the additional services offered by imc. This includes, for example, collection and delivery services to calibrate the measurement devices.

Result

Precision, quality and productivity – when two companies like TRUMPF and imc share the same values, an outstanding basis for a long-term partnership is created – especially for developing innovative products.

Co-authors of these application notes were: Mr. Eberhard Schneider and Mr. Uwe Bockermann from TRUMPF

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For over 25 years, imc Meßsysteme GmbH has been developing, manufacturing and selling hardware and software solutions worldwide in the field of physical measurement technology. Whether in a vehicle, on a test bench or monitoring plants and machinery – data acquisition with imc systems is considered productive, user-friendly and profitable. So whether needed in research, development, testing or commissioning, imc offers complete turnkey solutions, as well as standardized measurement devices and software products.
imc measurement systems work in mechanical and mechatronic applications offering up to 100 kHz sampling rate per channel with most popular sensors for measuring physical quantities, such as pressure, force, speed, vibration, noise, temperature, voltage or current. The spectrum of imc measurement products and services ranges from simple data recording via integrated real-time calculations, to the integration of models and complete automation of test benches.
Founded in 1988 and headquartered in Berlin, imc Meßsysteme GmbH employs around 160 employees who are continuously working hard to further develop the product portfolio. Internationally, imc products are distributed and sold through our 25 partner companies.

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imc Test & Measurement GmbH is a system house that offers products and services for measurement applications. Our team of about 40 proven experts, having mainly backgrounds in engineering or science, work to realize customer-oriented and application-specific solutions on the subject of "electrical measurement of physical quantities."

imc Test & Measurement GmbH markets the recognizably innovative and powerful hardware and software products from their strategic partner, imc Meßsysteme GmbH, Berlin.
We complement these products with our comprehensive engineering services. These range from design, consulting and sales, with pre-and after-sales service, as well as customer and application-specific extensions, system integration, commissioning, training, rental of measuring systems, personnel contracting and much more.

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