

Digital Transformation in Test Bench Technology

Valve Testing and Development at SAMSON AG



Fig. 1: ROLF SANDVOSS INNOVATION CENTER in Frankfurt

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SAMSON AG in Frankfurt, Germany has been manufacturing valves in many different sizes for common process-engineering materials for over 100 years. Wherever oils, gases, vapors and chemical substances are controlled or regulated, a SAMSON valve can be found. With the help of measurement technology from imc Test & Measurement GmbH, these valves are put through their paces at the new development test center "ROLF SANDVOSS INNOVATION CENTER". By connecting the development test center to the Cloud, the measurement data from the imc test benches can be retrieved and analyzed worldwide, depending on access rights.



ROLF SANDVOSS INNOVATION CENTER

At the end of 2017, SAMSON AG officially opened the “ROLF SANDVOSS INNOVATION CENTER” on its site in Frankfurt. Valves are developed, tested and certified on an area of 7000 m². It is the world's most modern development test center for valve technology.

imc Test & Measurement GmbH provides the measuring and control equipment for 16 test fields with 195 test stations in the areas of fluid mechanics, life cycle analysis and plant engineering.

Each test station is connected to the Cloud via **imc STUDIO** measurement software, which is used for data acquisition, visualization, automation and test bench control. The results of the test stations can be used by all SAMSON locations worldwide, depending on authorization and access rights.



Fig. 2: imc CRONOSflex DAQ system and -modules

System overview:

imc Measurement Device	Qty.
imc CRONOSflex (CRFX)	17
Modules	
CRFX/2000GP CRONOSflex base unit with aggregate sampling rate of 2000kHz	9
CRFX/400 CRONOSflex base unit with aggregate sampling rate of 400kHz	8
CRFX/LV3-8 The LV3-8 is a differential amplifier with 8 channels for measuring IEPE/ICP sensors.	96
CRFX/DI2-16 Galvanically isolated DI module for digital signals and control applications with 16 digital input	4
CRFX/DO-16-HC Module providing control and actuating outputs for control applications	12
CRFX/OFA Real time control platform integrated into the base units	17
imc CANSAS DAC-8 8-channel analog output module for voltage and current output	29
CRFX/HiL imc “Hardware-in-the-Loop”	1
imc Software	
imc Online FAMOS Pro Real-time data analysis platform for imc CRONOS devices	
imc STUDIO Pro Comprehensive measurement software for the entire test process: measurement, visualization, automation, data analysis	
imc FAMOS Enterprise + imc FAMOS Pro Data post-processing, analysis and visualization	

The Facility

From the supply of the test center to the individual test benches, **imc** provides an integrated measurement system. It can be controlled from a central control room in the building, via the Cloud or via mobile devices.

In the test center, valves can be tested for all relevant variables. These include pressure, noise emissions (external noise, structure-borne noise and internal noise), temperature and flow rate. The **imc DAQ systems** acquire and evaluate these characteristic values from 16 test fields. Thanks to the flexibility of configuration in **imc STUDIO**, a unique experiment was created for each test field and optimized with regard to the measurement task.

The Measurement Systems from imc

The development test center is equipped with one **imc CRONOSflex** system per test field. This is a modular DAQ system which consists of a base unit and one or more measurement modules. The total sampling rate is up to 2000 kHz per base unit, depending on the version.

There are many possibilities when it comes to selecting acquisition front end modules. Depending on the measurement variable being tested, a suitable module is used. SAMSON mainly uses modules for control applications and ICP/IEPE sensors.

The integrated measurement and control systems carry out both data acquisition as well as real time control tasks for the facility process.

imc Online FAMOS is a signal processing platform integrated in the device for the acquisition and processing of measurement data in real time. Time-synchronous and deterministic, **imc Online FAMOS** can perform cross-channel mathematical calculations, create statistics, make comparisons or calculate and execute sophisticated control algorithms.

Facility design



Fig. 3: Plant engineering at the ROLF SANDVOSS INNOVATION CENTER by SAMSON © SAMSON AG

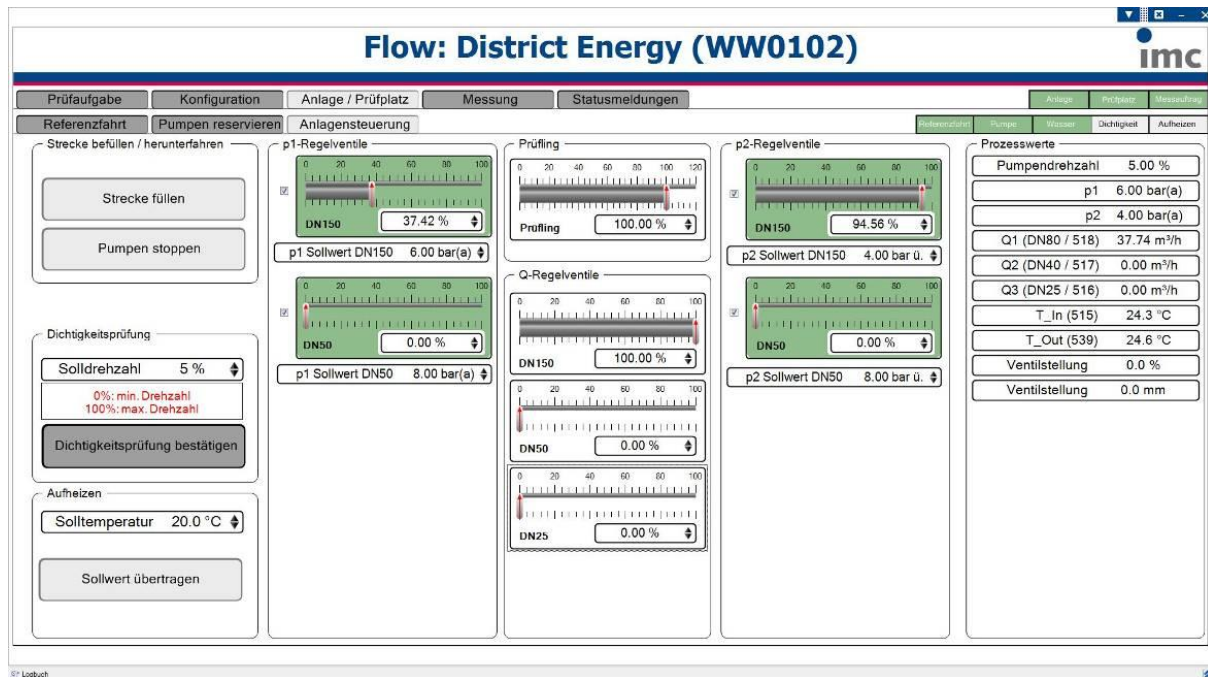


Fig. 4: Facility control using imc STUDIO

The facility design enables different testing tasks, media and process conditions. More than 2 kilometers of piping and 18 modular pumps are installed at the SAMSON test center in order to meet these requirements. The pumps ensure that all test fields are supplied

with the correct media (steam, gases, fluids, etc.) at precisely defined parameters (pressure, temperature). The system consists of more than 250 valves, which are controlled by **imc CRONOSflex** modules.

Life Cycle Testing



Fig. 5: Life cycle test field © SAMSON AG

For life cycle tests on individual components and on complete control valves, 91 test stations are available. The test objects are examined with regard to their resilience in terms of chemical, thermal, mechanical, fluidic and climatic stress. Pressure, temperature and sound emissions are measured using IEPE sensors and processed using an **imc CRONOSflex** system.

In this context, the occurrence of cavitation in various media and valves is measured. This physical phenomenon creates unstable gas

bubbles in the fluid, which implode after a certain time and generate pressure waves. These pressure waves wear valves over time and damage occurs, thus reducing the service life of the valves.

The pressure waves generate a structure-borne sound at the valve, which is acquired with an accelerometer. The result is a vibration characteristic which is captured and output. On the basis of this characteristic, a test engineer draws conclusions about the cavitation.

Flow Testing



Fig. 6: Flow lab: District Energy © SAMSON AG



Fig. 7: Flow lab for large valves © SAMSON AG

There are 16 flow labs (flow through test benches) within the facility. These can simulate all medium states – liquid, gaseous, vaporous and multi-phase, up to solid-laden liquids. The **imc CRONOSflex** determines pres-

sure, sound emissions, temperature and flow rate.

imc STUDIO generates the corresponding diagrams and characteristic curves.

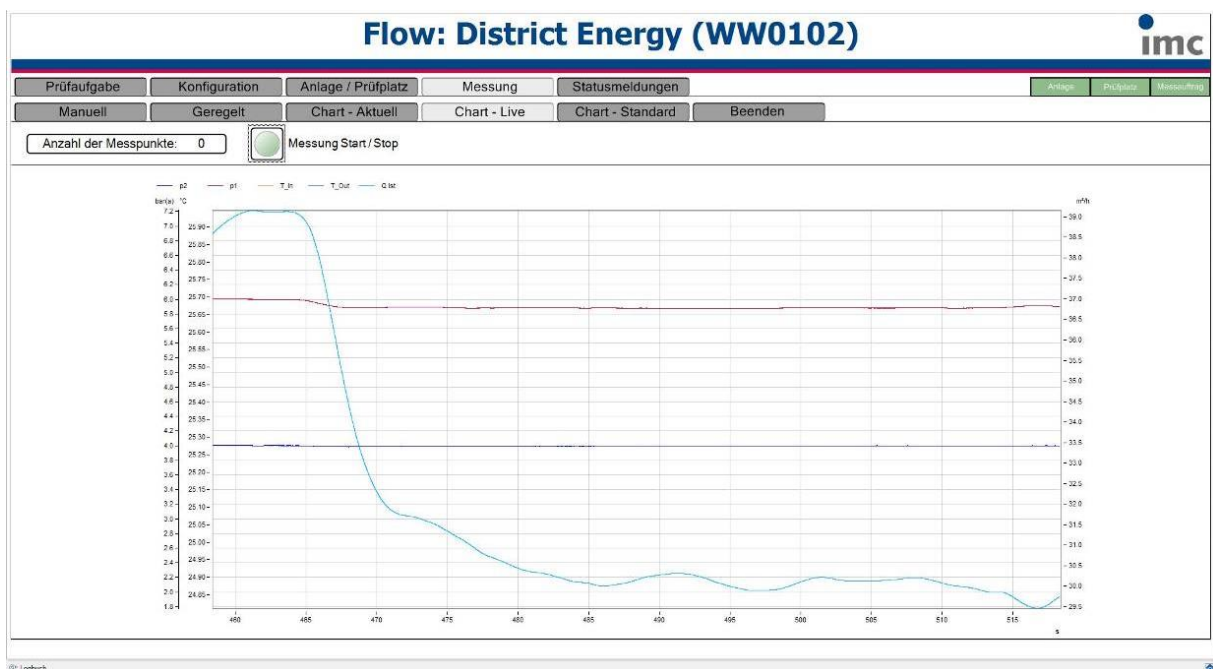


Fig. 8: Live chart in imc STUDIO

Testing with imc

Automated

All testing carried out in the development test center with **imc measurement systems** can be fully automated. This means that the set-up of the experiments takes place in advance. Testing starts at a specified time and follow the defined test protocol exactly. This saves time and resources, which is fully in line with the imc claim “productive testing”.

Integrated

A key advantage of **imc measurement technology** is the ability to completely integrate the DAQ system into SAMSON's digital infrastructure.

The development test center is networked worldwide with the all affiliated parties through a modern connection to the Cloud. This means that every location, whether in the USA, Germany or China, can access the testing

center's measurement systems via this cloud, depending on their respective access rights. The “ROLF SANDVOSS INNOVATION CENTER” thus offers a decisive development advantage for the entire company group.

Even in the cloud, test data are captured in real time and evaluation can take place during the running test process.

This is achieved by setting up many individual **imc STUDIO** panels for each test station. Via these panels, each test bench is individually controlled and the measurement is set-up and started. Resources, such as pumps, are also reserved here. The use of a test bench excludes other users in order to prevent access conflicts.

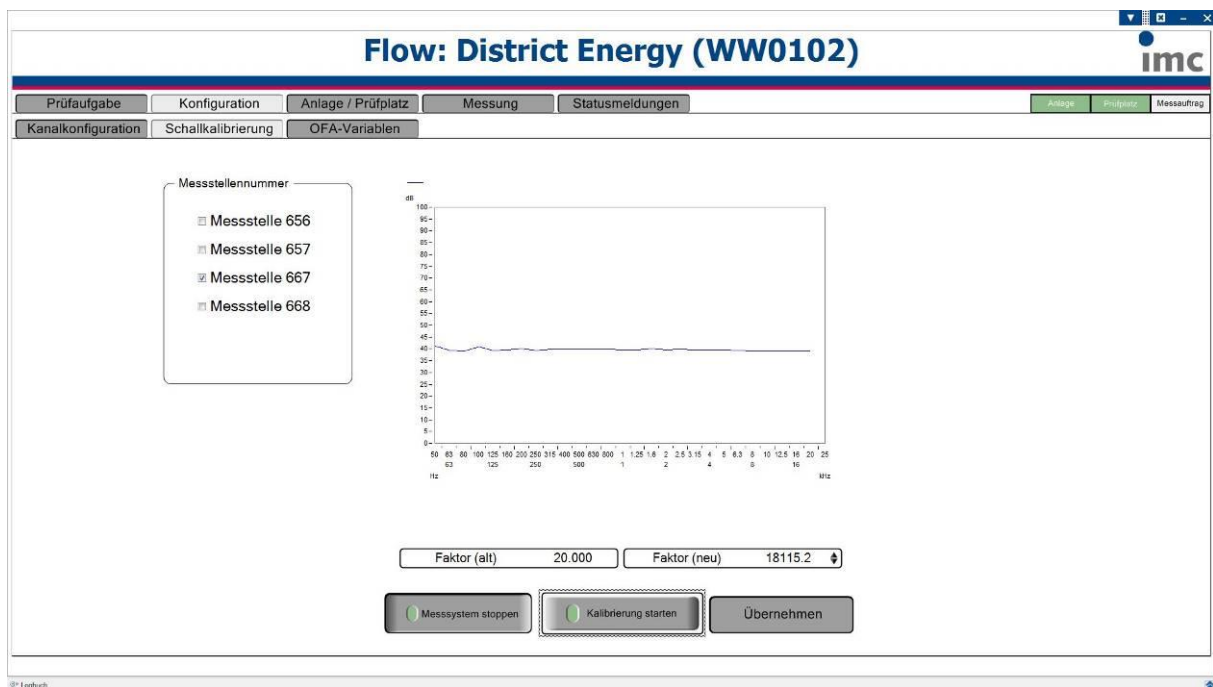


Fig. 9: Semi-automatic measurement with imc STUDIO

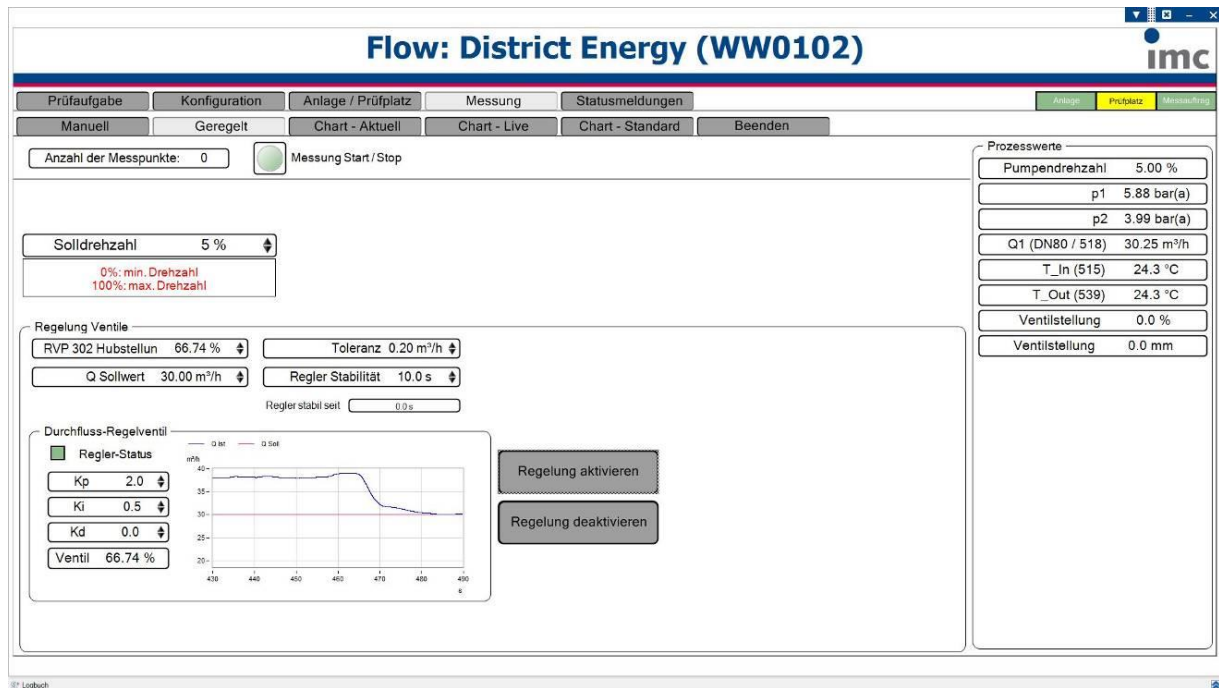


Fig. 10: imc STUDIO Panel

Test data evaluation

After acquisition with **imc STUDIO**, the test data are exported to **imc FAMOS** and evaluated. Numerous analysis functions are available here for professional measurement data evaluation and provide fast results. The mathematical function library contains over 500 functions. The macro language, so-called imc FAMOS sequences, enables fast and simple automation. The possibility to load and save different data formats and to choose versatile visualization options is one of the central functions of **imc FAMOS**. Here too, the evaluation can already begin during the test process.

Conclusion

At SAMSON, **imc** provides a complex measurement and control system for a state-of-the-art facility. The system is networked worldwide and can be fully integrated into the Cloud. This means that not only the actual "ROLF SANDVOSS INNOVATION CENTER" benefits directly from **imc measurement technology**, but also the entire global corporation. This saves time and money. In addition, development in an industry 4.0 environment creates a know-how advantage through the networking of different disciplines. In this way, SAMSON is equipped for the future with cutting-edge measurement technology and the best possible preparation for new challenges.

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imc Test & Measurement GmbH is a manufacturer and solution provider of productive test and measurement systems. imc implements metrological solutions for research, development, service and production. imc has particular expertise in the design and production of turnkey electric motor test benches. Precisely outfitted sensor and telemetry systems complement our customer applications.

Our customers from the fields of automotive engineering, mechanical engineering, railway, aerospace and energy use imc measurement devices, software solutions and test stands to validate prototypes, optimize products, monitor processes and gain insights from measurement data. As a solution

provider, imc offers their customers an attractive and comprehensive range of services. These include project consulting, contracted measurements, data evaluation, specialist deployment, customer-specific software development and system integration. imc consistently pursues its claim of providing services for “productive testing”.

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