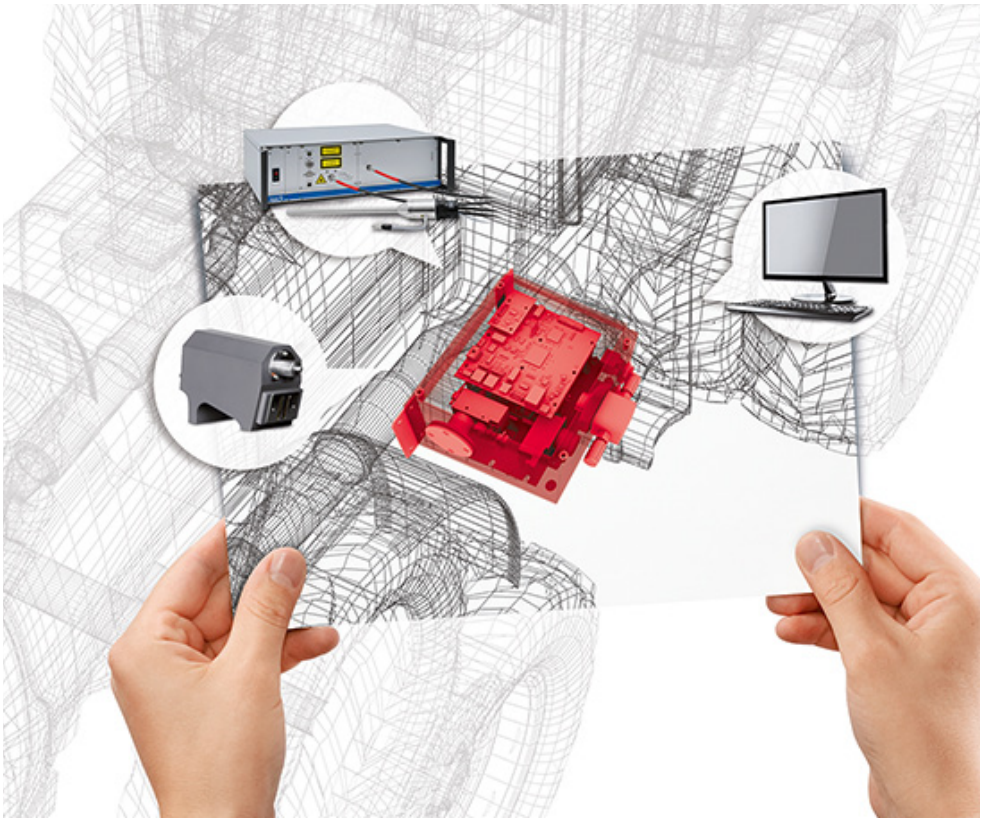
tecSaaS – Spectrometer as a Sensor

Based on UV–VIS–NIR spectroscopy, the modular platform tecSaaS is a baseline for effectively implementing stand-alone sensors with embedded processing for industrial or mobile applications.

A powerful on-board processor architecture with modular software/firmware processes the data of UV-VIS-NIR spectral sensors in real-time and only passes relevant results to the process interface. For data evaluation, tecSaaS even offers complex algorithms such as chemometrics or FFT and allows to define customized mathematical processing using the integrated formula parser. For monitoring and parametrization, PC software and an Android App are available.

Parameterization of software instead of programming and a pool of diverse hardware modules lead to a fast time-to-market from the idea up to a stand-alone serial system without PC, starting even at smaller quantities.



[Features]

- A wide choice of sensor technologies is supported, such as UV-VIS-NIR spectral sensors and photometers
- Process integration can be realized using e.g. Modbus/TCP, CAN, ISOBUS and other process interfaces
- Modular software [firmware] architecture enables
  - Flexible choice of functions and parameterization
  - Integration of customer-specific add-on modules [special “build”]
  - Proprietary processing modules algorithms can be integrated as binary code
- Chemometrics software – online predictors are implemented, models created for a PC system can be used
- Generic, compact, with local data processing for independent systems based on a spectral sensor
- Predefined hardware core architecture – CPU, FPGA, memory, interfaces
- Setup only by parameterization or special build for customized projects
- Parameterization of software instead of programming – no professional programmer is required

[Supported Sensor Technologies]

tecSaaS systems use diode array based spectral sensors with CCD, CMOS, NMOS or InGaAs detector technology or filtered photodiodes. The platform supports single or dual channel referencing configurations.

[Core Hardware architecture]

The system control and data processing electronics hardware has been predefined with special attention to the requirements of controlling / reading the sensors and to the typical data processing used in spectroscopy. It includes an ARM Cortex M4 type CPU, an FPGA with sufficient power for additional spectral data processing as well as suitable memory and relevant electrical interfaces.

[Firmware]

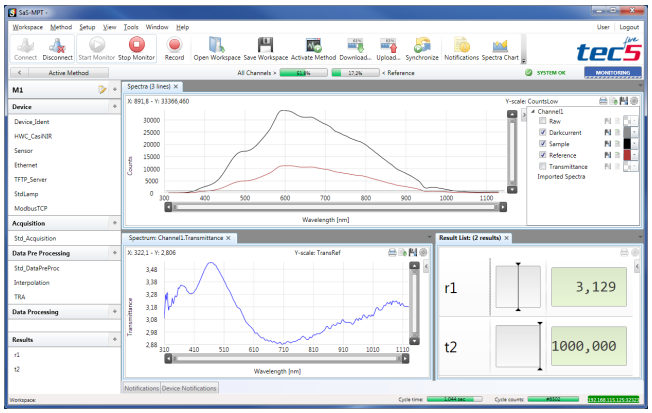
Based on a lean real-time operating system, modular firmware is ready for use, only requiring configuration selection and parameter setting. It supports the functions required for instrument control, spectral data acquisition/processing and process communication. A formula parser can be used to define mathematics generating the results for the control system. In addition, complex processing modules, e.g. for chemometric prediction, are implemented.
For higher quantities or customized projects, special firmware builds can be provided. This also allows including a customer's proprietary algorithm as a binary code.

[Process Interface]

As a standard interface, Modbus/TCP was selected to transfer results to the process control system. Alternatively, other Ethernet, CAN or serial interface based communication is possible on request. Optionally, results or spectra can be logged to a USB stick or SD card on the system.

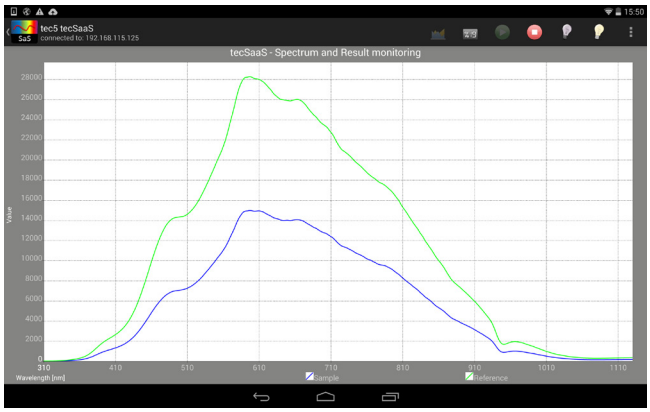
[Setup and Monitoring Tools]

For startup, deployment, parameter setting or monitoring purposes, the unit can be connected to a PC over an Ethernet connection. tec5 provides a PC software "MPT", the online monitoring and parameterization tool for tecSaaS to access the sensor. It is an easy-to-use Windows tool, which allows workspace and method administration in a similar way as PC-based spectroscopy software from tec5 [MultiSpec Pro II].



[MPT user surface]

Alternatively, Spectra and results may be monitored by an Android APP provided by tec5. In this way, the sensor operation can be supervised quickly and easily without a wired connection.



[Android App]

[Reliability and Security Considerations]

The tecSaaS platform was designed for productive industrial and mobile applications, in which reliable and secure operation are most important. For this purpose, we use hardware and firmware dedicated to the instrument purpose and to the sensors in use with a lean operating system, in which only functionality required for the application is available.
Limiting functionality to what is really needed not only reduces the failure potential, but also reserves the controller's resources to the tasks required for the application, not wasting computing power to unneeded functionality. In this way, real-time performance can be achieved for many in-line applications. At the same time, limiting the number and type of external interfaces helps to avoid unnecessary security hazards.

For detailed considerations concerning security of a sensor in industrial control systems, please refer to our white paper.

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