Spectrometer Systems Overview
tec5 was founded in 1993 and is a leading provider of spectroscopy components, units and systems. We integrate high quality photonic components featuring fast operation and high sensitivity to create systems for process control. Our products are utilized to monitor critical production steps in a wide variety of industries.

Direct collaboration with our partners, leading manufacturers of key optical and electronic components, provides us with superior tools to meet the demands of the most challenging spectroscopic applications. Our U.S. team of scientists and engineers are experts in spectroscopic hardware, including optics, electronics and mechanics.

**Applications:**
- Analysis of etching baths
- Biomass determination
- Color determination of fatty alcohols (oleochemicals)
- Inspection of dip coated glass panes
- Layer thickness on silicon wafers via ellipsometry
- LED emission profiling
- Monitoring of solar irradiance
- Plasma emission monitoring
- Polypropylene in a polyethylene terephthalate base
- Qualification of pulsed solar simulators
- Qualification of vegetable-derived oil products
- Quality control of deposition processes in vacuum
- Quantification of wax in master batches
- and many more...

**Industries:**
- Agriculture
- Biotech
- Chemical
- Food
- Optical
- Pharmaceutical
- Semicon
- Solar
- and more
We specialize in the creation of multi-channel systems, and offer multiplexing based on electronic controllers, opto-mechanical shutters and piezoelectrically-operated fiber-optic switches. Multiple channels permit the measurement of multiple sample points, and a dedicated reference channel. Our electronic multiplexer boards accommodate up to 8 PDA-based spectrometers to be controlled via a single host interface. The opto-mechanical shutter solution is a low-cost option for up to 4 channels that provides 100% channel reproducibility. Our fiber-optic switches can expand your sampling capabilities up to 32 channels, with excellent reproducibility and significant reduction in cost.

Our spectrometers are built for process. The spectrometer modules are specially constructed to resist the rigors of harsh environments, and feature fixed optics and thermally-stabilized packaging, ensuring that your spectrometer will remain permanently calibrated and resistant to temperature variation and mechanical influence from environmental vibrations and shock. Customizable housing options are available. A variety of process communications architectures and protocols are supported.

Our UV-VIS-NIR systems cover various wavelength ranges between 190 – 2150 nm. The Raman system uses a 785 nm excitation source and covers 300 – 3100 cm\(^{-1}\). Drawing upon a broad range of expertise designing systems, and utilizing a wide array of modular components, we can furnish a product matched to the most exacting technical requirements.
**CompactSpec®**

CompactSpec® is a process-ready spectrometer system for harsh environments, with protection against dust and water (i.e. IP54 or IP65), expandable up to 8 channels. Spectrometers, light sources and measuring heads are available as modular components that comprise a complete system.

**CompactSpec® II**

CompactSpec® II is a process-ready spectrometer system for harsh environments, with a light source, integrated PC and touchscreen in IP65 housing. Optional protection for environments requiring explosion-proof operation (Zones 1 and 2, ATEX certified) and Vortec cooling is available. Multiplexing technology can expand sampling up to 8 channels, and may incorporate a dedicated reference channel.

**MultiSpec® Systems**

MultiSpec® is a system suitable for use in both laboratory and process environments. Housed in a standard 19” rackmount enclosure (3U), it may be equipped with quick-change UV-VIS, NIR or Raman spectrometer cartridges. An extended (6U) enclosure enables operation of two spectrometers concurrently: UV-VIS and NIR, UV-VIS and Raman, or NIR and Raman (each operating in conjunction with suitable light sources selected from among D2/Halogen, Halogen, Laser [785 nm] or Xenon Flash).

**tecSpec®/tecSpec® Pro**

tecSpec® and tecSpec® Pro are compact and cost effective units suited for method development, and readily integrate into process designs for online inspection. tecSpec® units house light sources and spectrometer modules individually. The tecSpec® Pro features an Ethernet interface, with integrated data preprocessing.
We specialize in the design and manufacturing of OEM spectrometer units customized to the requirements of instrument integrators, manufacturers and end-users, and collaborate with clients around the globe to help them realize their customized analytical solutions.

**Yara N-Sensor ALS**

The Yara N-Sensor ALS (Active Light Source) is a unique, mobile industrial spectroscopy system. The system mounts to the roof of a commercial tractor, and is designed to withstand thermal shifts, moisture, vibrations and shock. The sensing system works in conjunction with specially developed methods for determining crop health parameters (such as nitrogen levels and biomass), and operates the application of fertilizer, minimizing waste and promoting optimal crop growth. A Xenon flash lamp source has been integrated to permit extended periods of operation and coverage of more acreage (versus measurements collected from natural sunlight reflectance). The Yara may be linked to DPGS crop mapping, and possible process interfaces include CANbus, Modbus and TCP/IP.

*Developed in conjunction with Yara International.*

**Lens Color Analyzer (TFM-1)**

The Lens Color Analyzer (TFM-1) is a dedicated, visual inspection system for ophthalmic lenses, suitable for use in both production and development environments. The TFM-1 enables the rapid, accurate determination of color values [L*a*b*], UV transmittivity (TUV 380 nm and TUV 400 nm), and light transmittance (TV), as well as additional parameters according to DIN EN ISO 8980-3. Specially developed software completes the interface. Spectra are compared versus reference data stored in a local or remote SQL database. During routine operation, a single button press triggers data acquisition, performs library comparison, and furnishes product refinement instructions to the operator.

*Developed in conjunction with Rodenstock, Germany.*
MultiSpec® Pro II

MultiSpec® Pro II combines data acquisition and handling, graphical display, and instrument control and monitoring in a single platform. Programmed in the .NET architecture and featuring an interface built on Windows Presentation Foundation (WPF), MultiSpec® Pro II is compatible with Windows XP, Vista, 7, 8, and 10 (32-bit/64-bit).

The functionality can be expanded through additional modules.

Development Tools

Software Development Kits:
Two libraries (SDACQ32MP/SDPROC32) are offered for instrumentation users interested to implement a custom software solution. The function libraries are coded in C/C++ (all exported functions follow the standard C conventions) and supplied as dynamic-link library (DLL) files. The libraries are compatible with Visual Basic, and interfaces are provided to .NET as well.

LabVIEW(TM) Instrument Driver:
This package provides VIs for data acquisition and processing, and includes application examples.

Embedded Control

The tecSaaS® (Spectrometer as a Sensor) technology platform incorporates integrated processing capabilities and a real-time operating system. tecSaaS utilizes a modular firmware design that may be modified to expand its processing capabilities, including evaluation of complex algorithms and chemometric and mathematical methods, such as Fast Fourier Transforms (FFT). The addition of a light source and spectrometer module completes tecSaaS technology as a self-contained spectrometer unit.
Light Guides

Light guides are an important component in optimizing an optical system as they connect the functional units such as the light source to a probe or a probe to the spectrometer. They can distribute light to various channels, collecting light from sample positions or sending light to multiple spectrometer channels. Light guides also allow access to measurement points inaccessible to a spectrometer due to extremes in pressure, temperature, dust, moisture, shock, or vibration. Smart fiber-optic designs can eliminate the need for complex measuring probes, saving both time and money.

Options:
- Monofiber and bundle extensions
- Multifucation
- Cross-section converters
- Homogenizers
- Aperture converters

Probes & Measuring Heads

Fiber-optically coupled measuring cells and probes are available in a variety of designs and materials for solids, liquids and gases. The probes are built to meet customer demands in temperature, pressure and chemical resistivity. Typical body construction materials include hastelloy, quartz, stainless steel, tantalum, Teflon™ (PTFE) and titanium; optical paths can be fitted with quartz or sapphire. Special features like brazed windows, flange mounts and advanced designs featuring retractable housings are also available.

Probe Characteristics:
- Gap sizes: 1 to 50 mm
- Up to 350°C & 300 bar

Measurement heads function in a similar role as probes, providing the interface to the sample, and also include additional design elements to improve measurements. The NIRON II measuring head features a dual-lamp configuration, and an electronics interface that senses primary lamp failure and activates the backup lamp automatically. The RTP measuring head is a unique design specifically for coated glass, that performs both reflection and transmission measurements simultaneously.