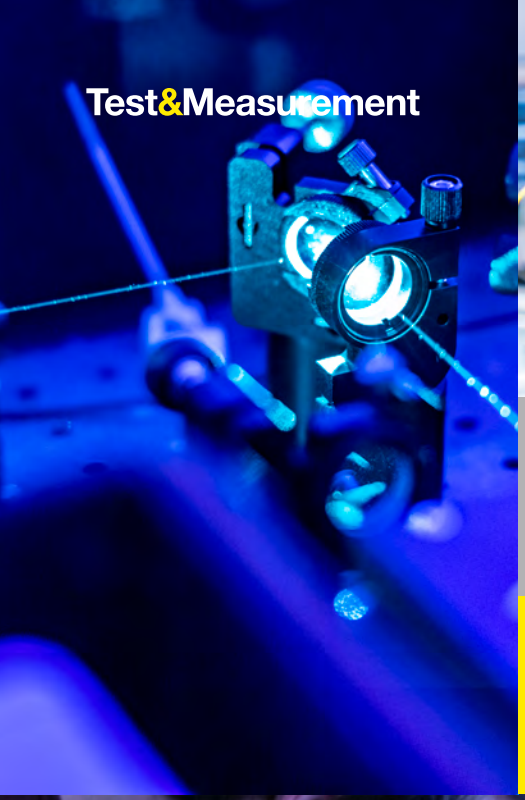
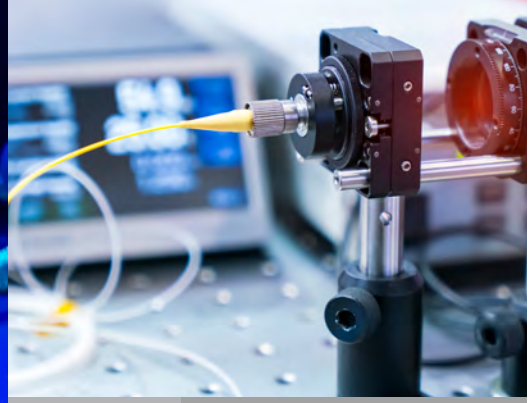
Test&Measurement

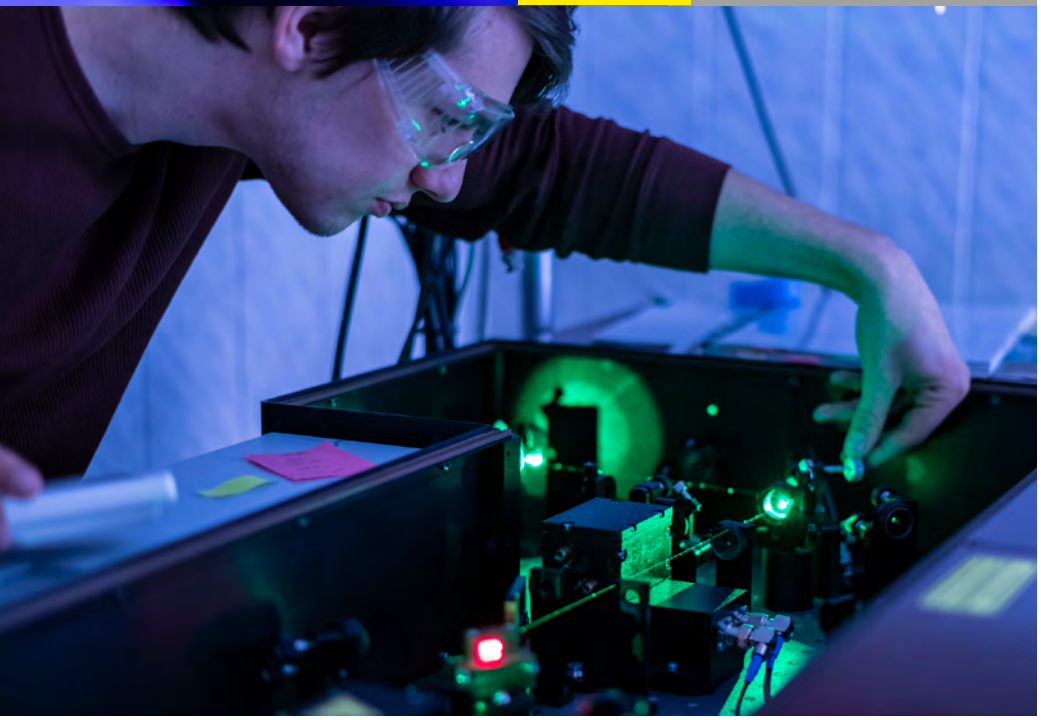
YOKOGAWA

Unlocking the Potential of Laser Innovations

Precision Making







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Laser Technology Challenges and the Role of Precision Measurement

From semiconductor manufacturing and medical systems to quantum technology and advanced sensing, lasers are at the core of modern innovation. Manufacturers of telecommunication, medical, and industrial lasers, as well as laser system integrators, operate in an environment of increasing demands for precision, safety, and reliability. Ultrashort pulses, high energy density, and strict regulatory standards make testing and measurement not a supporting function, but a critical element of development and production. The result: fewer redesign cycles, faster time to market, and laser systems that perform reliably from day one.

Pulse Stability and Parameter Repeatability

For telecommunication, medical lasers, as well as industrial systems for micromachining and high-precision cutting, the following are critical: pulse energy stability and precise pulse duration, minimal jitter and absence of parasitic pulses with pulse-to-pulse repeatability. As even minor fluctuations can lead to risks for patients, inconsistent processing quality or increased scrap rates. High-resolution waveform capture and spectral analysis enable early detection of pulse anomalies, helping R&D teams isolate root causes before they reach the production line.

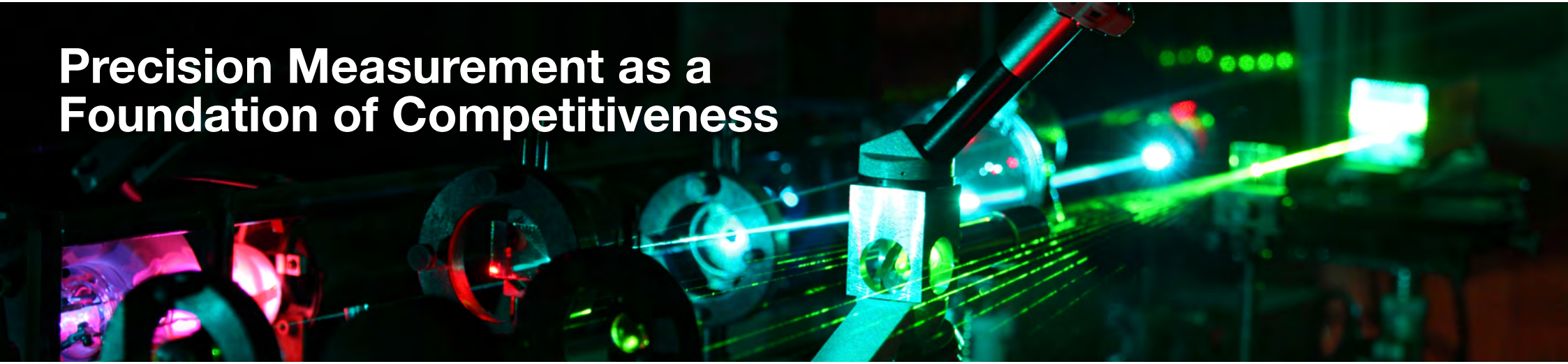
Spectral Performance and Wavelength Accuracy

For optical communication, spectroscopy, and sensing applications, precise control of the laser's spectral characteristics is essential. Even small wavelength deviations or unwanted emission components can affect system performance, reduce measurement sensitivity, or introduce errors. Parameters such as emission wavelength accuracy, wavelength stability, spectral linewidth, side-mode suppression, and amplified spontaneous emission (ASE) must be carefully characterized to ensure reliable and stable laser operation.

System Reliability and Energy Efficiency

Modern lasers must be designed for long-term continuous operation, energy efficiency, and resistance to thermal and mechanical stress. Key risk factors include overheating of laser diodes, output power degradation, instability during extended operation, and influence of power supply noise and vibration. Validating system-level performance before shipping, through burn-in testing, power efficiency analysis, and multi-channel monitoring - is what separates reliable products.

Precision Measurement as a Foundation of Competitiveness



In the world of laser technology, precision is everything. Whether you are developing cutting-edge lasers or integrating them into complex systems, you need reliable tools to ensure peak performance and efficiency. Yokogawa offers a comprehensive suite of solutions to support every stage of laser innovation helping manufacturers improve quality and repeatability, ensure compliance with standards, reduce risks and redesign costs, accelerate development cycles, and increase end-product reliability.

Optical and waveform measurement instruments enable precise monitoring of laser emission behavior and rapid detection of instabilities that affect pulse-to-pulse repeatability.

- Optical spectral analysis to monitor spectral stability, linewidth, and unwanted emission components
- High-resolution optical reflectometry for identifying reflections or optical path disturbances that may introduce pulse distortion (high-resolution reflectometers)
- High-resolution waveform capture for characterizing pulse shape, jitter, and timing of laser driver signals (mixed signal oscilloscopes)

Together, these solutions help engineering teams detect pulse anomalies early, stabilize laser output, and achieve reliable, repeatable system performance during development and validation.

Accurate spectral analysis is essential for evaluating laser emission, DWDM signals, and photonic sources across a wide range of wavelength regions.

- High spectral resolution for precise analysis of laser emission characteristics and wide wavelength coverage from visible to mid-infrared regions (optical spectrum analyzers)
- High dynamic range for detecting weak spectral components such as ASE and side modes
- Ultra-high wavelength accuracy using wavelength meters to verify wavelength stability during operation (optical wave-length meters)

Complementary electrical characterization with source measure units also enables accurate current sourcing and measurement for laser diodes and photonic components, supporting reliable testing and performance optimization.

Reliable characterization of electrical, thermal, and optical parameters is essential to ensure stable, efficient, and durable laser operation over time.

- Driver and power supply characterization using precision source measure units for accurate current sourcing and electrical efficiency evaluation (signal sources)
- Spectral monitoring of laser emission to detect early degradation or instability in optical output (spectrum analyzers)
- Power stability analysis to verify wall-plug efficiency and identify energy losses in laser driver circuits (power analyzers)
- Long-term monitoring and burn-in testing with data acquisition systems to record voltage, current, temperature, and optical output over extended periods (data recorders, isolated oscilloscopes)

Identify key operating parameters and support the development of reliable, energy-efficient laser systems.

Equipment applications and benefits

Purpose-built instruments that deliver measurable impact across laser R&D, characterization, and production – reducing time-to-market, minimizing field returns, and giving your engineering team the confidence to ship reliable products at scale.

Optical Spectrum Analyzer (OSA)

Get strong laser line with minimal unwanted signals by revealing the full spectral behavior of the laser systems

- Excel at measuring side modes, ASE and signal-to-noise ratio
- Wide wavelength coverage from 350nm to 5500 nm (across the Yokogawa OSA portfolio)
- Various resolution and sensitivity settings
- High close-in dynamic range is crucial for accurate analysis of narrow-linewidth lasers

Source Measure Unit

Precise current sourcing and electrical characterization for laser diode testing

- Understand laser behavior across different operating conditions (together with spectrum analyzer)
- Precisely measure and analyze the laser's characteristics, including thermoelectric cooler and photodiode function
- Space-saving, multi-channel solution that drive laser diodes with precisely controlled currents
- Conduct comprehensive testing of laser diodes at low, medium, and high threshold levels

Optical Wavelength Meter

Lock in precise laser frequency with absolute wavelength accuracy for stable and repeatable system performance

- Ultra-high wavelength accuracy ±0.2 ppm and repeatability
- Fast update rates for real-time laser stabilization
- High resolution to detect minor frequency shifts
- Long-term stability for demanding laboratory and industrial environments

High Resolution Reflectometer

Explore optical assemblies with sub-millimeter resolution to optimize coupling and detect microcracks

- Pinpoint reflections and identify areas for improvement
- Detect microcracks that standard loss measurements might miss
- 40 µm spatial resolution with spurious noise suppression down to –100 dB
- Verification of integrated photonic assemblies and optical connectors

Multi Application Test System

Flexible optical testing for laser and photonic device development

- Modular platform supporting multiple optical measurement modules
- Scalable configuration for laser R&D, validation, and production testing
- High stability measurements for accurate optical device characterization
- Seamless integration of optical power meters, laser sources, and switches

Electrical Instrumentation

From driver waveforms to wall-plug efficiency insight

- Power analysis and high-definition waveform capture
- Seamless integration of waveform, power analysis, and thermal measurements
- Validation of electrical behavior across components, optimizing system efficiency and energy usage
- Trusted accuracy with industry-leading standards and certifications

Optical Spectrum Analyzers AQ6370E / AQ6374E / AQ6375E / AQ6377E
Ensure "clean" laser light

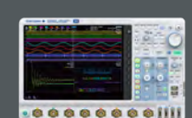
Source Measure Units GS610 / GS820
Convert optical signal into electrical ones

Wavelength meter AQ6151B
Accurately measure optical wavelength of optical devices and systems

High resolution reflectometer AQ7420
Ensure smooth and efficient light transmission

Test platform AQ2300
Ensure multi-application testing

Power Analyzer WT500



High-definition oscilloscope DLM5000HD

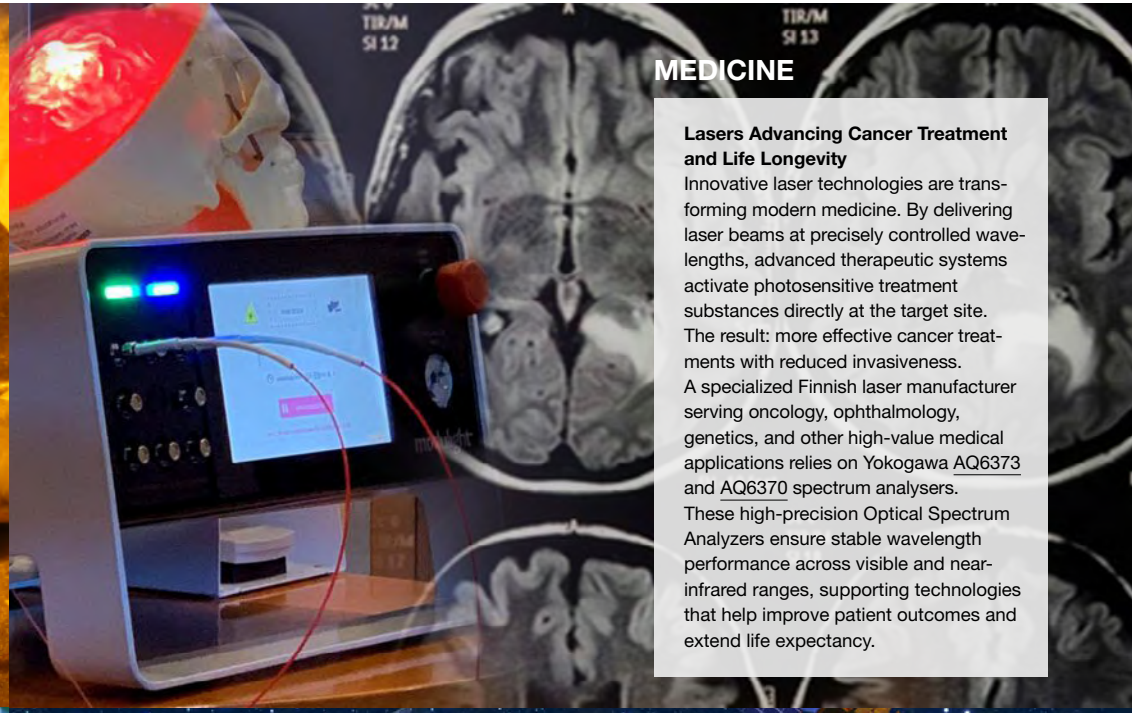
Insights into electrical performance of laser systems

Trusted Across Industries

From quantum computing and oncology to ultrafast research and satellite communications, Yokogawa instruments support laser innovation at every scale.

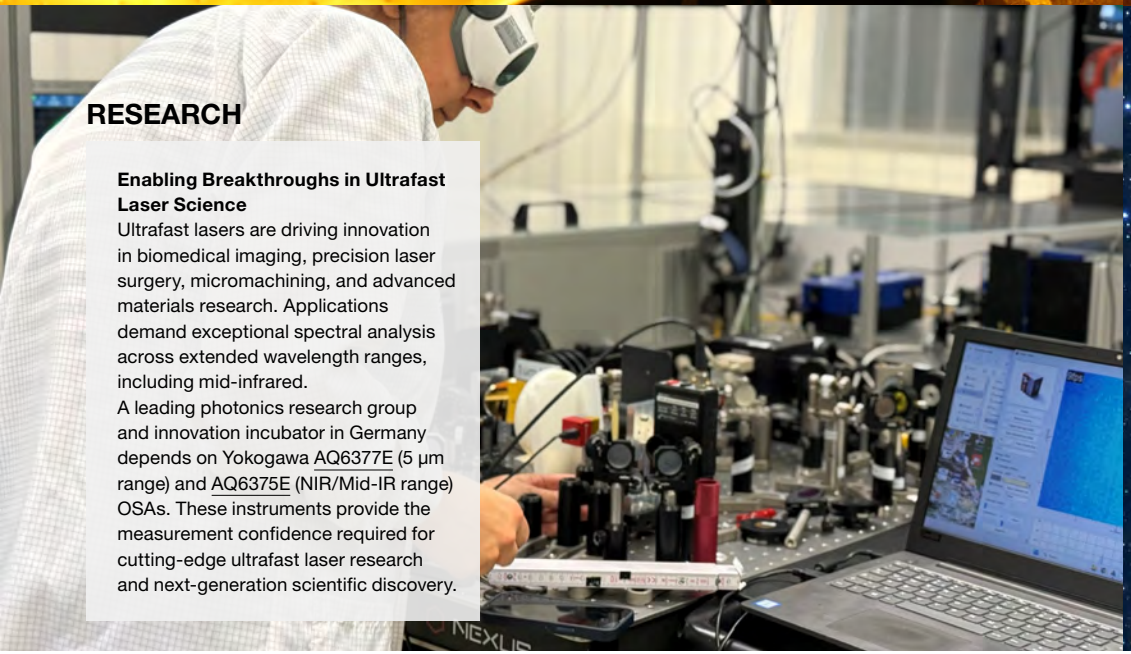
SCIENCE

Lasers Powering the Future of Quantum Computing
Quantum computing relies on highly specialized lasers capable of maintaining emission at extremely precise wavelengths in the visible and near-infrared spectrum. Even the slightest wavelength deviation can impact qubit stability and system performance. A Finland-based laser innovator serving quantum technology, medical, and semiconductor industries utilizes the Yokogawa AQ6370E High-Performance Optical Spectrum. Analyzer to ensure ultra-accurate wavelength control and spectral purity, helping turn quantum computing from theory into reality.



MEDICINE

Lasers Advancing Cancer Treatment and Life Longevity
Innovative laser technologies are transforming modern medicine. By delivering laser beams at precisely controlled wavelengths, advanced therapeutic systems activate photosensitive treatment substances directly at the target site. The result: more effective cancer treatments with reduced invasiveness.
A specialized Finnish laser manufacturer serving oncology, ophthalmology, genetics, and other high-value medical applications relies on Yokogawa AQ6373 and AQ6370 spectrum analysers. These high-precision Optical Spectrum Analyzers ensure stable wavelength performance across visible and near-infrared ranges, supporting technologies that help improve patient outcomes and extend life expectancy.



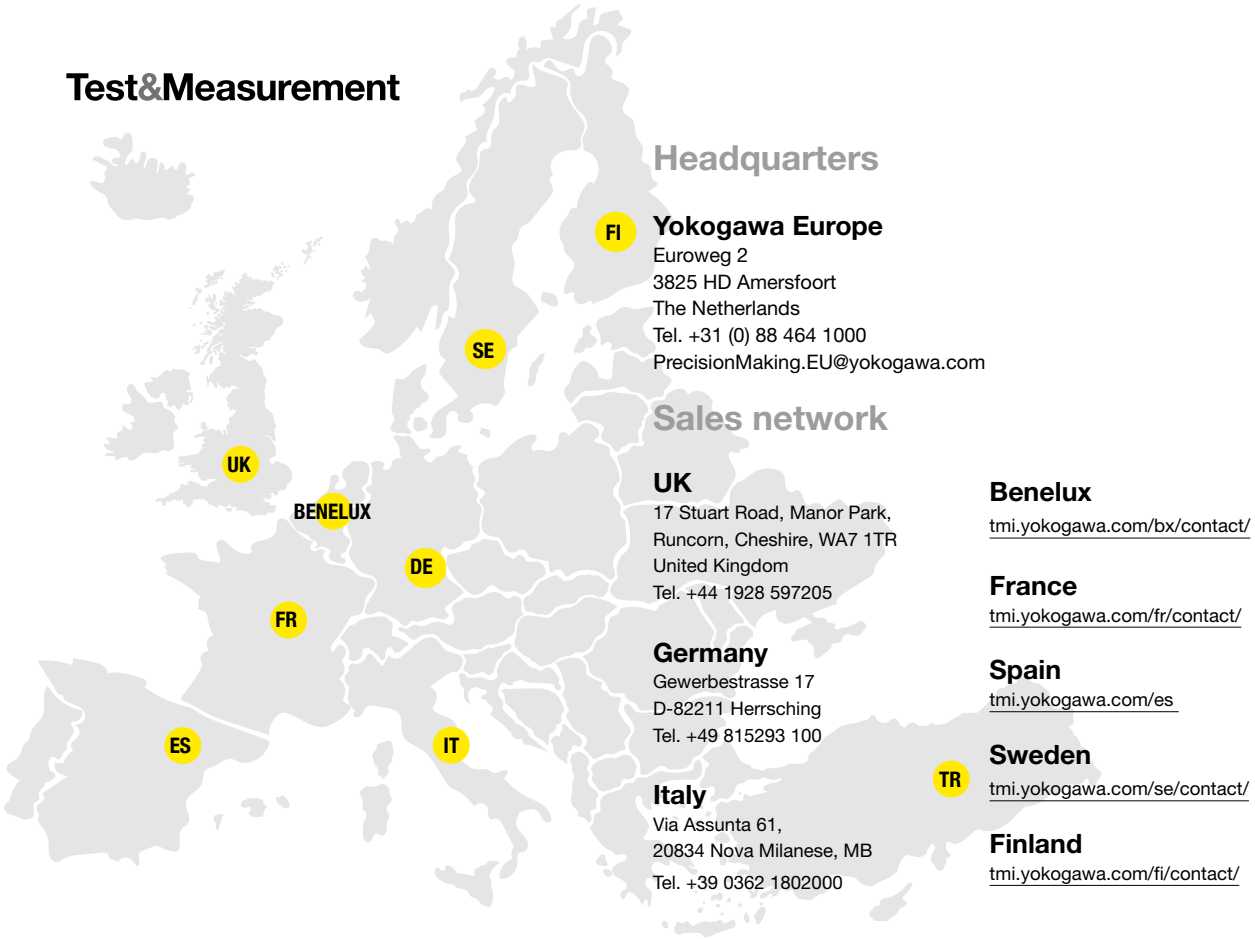
RESEARCH

Enabling Breakthroughs in Ultrafast Laser Science
Ultrafast lasers are driving innovation in biomedical imaging, precision laser surgery, micromachining, and advanced materials research. Applications demand exceptional spectral analysis across extended wavelength ranges, including mid-infrared.
A leading photonics research group and innovation incubator in Germany depends on Yokogawa AQ6377E (5 µm range) and AQ6375E (NIR/Mid-IR range) OSAs. These instruments provide the measurement confidence required for cutting-edge ultrafast laser research and next-generation scientific discovery.

AVIATION & AEROSPACE

Precision Laser Processing for High-Performance Components
Laser technologies play a critical role in cutting, welding, additive manufacturing, and surface processing for aviation and aerospace applications. Advanced laser metal deposition enables the precise repair of compressor and turbine blisks, allowing manufacturers to reduce costs by more than 90% compared to full component replacement.
A leading German industrial laser technology provider uses the Yokogawa AQ6375E Long-Wavelength Optical Spectrum Analyzer to ensure optimal laser performance for surface processing and high-precision manufacturing systems.

Test&Measurement



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Precision measurement solutions for laser R&D, characterization, and production: from prototype validation to volume manufacturing
In the world of laser technology, precision is everything. Whether you're developing cutting-edge lasers or integrating them into complex systems, you need reliable tools to ensure peak performance and efficiency. Yokogawa offers a comprehensive suite of solutions to speed up every stage of laser innovation.

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YOKOGAWA

Precision is all around us. In everything we see, everything we touch.

It means the difference between success and failure, safe and unsafe, sustainable and unsustainable.

But precision doesn't just happen. It's made.

We are the Precision Makers.