Process Guardian™
Raman Analyzer

High-resolution standalone analyzer for real-time process measurements and control

- In-line results in seconds
- Exceptional stability and reliability providing remote clients with access to 24/7 critical device parameters (system status, laser health, fault conditions), laser shutdown and acquisition pause when fault detected
- Integrated prediction engine options enable chemometric measurement of multiple mixture components and attributes from each spectral acquisition
- Fully embedded instrument control and spectral processing platform
- Tracking of calibration history and verification
- User-friendly button and rotary dial control
- LAN connectivity and industry standard communication protocols and dual independent network adapters (NICs)
- Rugged design protects internal components against external environment, no moving parts (except fans)
- Configurable for latching or non-latching
- Expandable to 4 or 8 channels with optional multiplexer accessory
- Supports OPIS 35™ IECEx/ATEX certified laser accessory

Measurements you can trust

The Process Guardian™ is a new Raman analyzer from Tornado. In addition to superior measurement performance, this next generation HTVS™-enabled analyzer embodies all critical requirements for straightforward deployment into a process environment. Uncompromised *measurements-you-can-trust* are now available from a ruggedized standalone platform.

High Throughput Virtual Slit (HTVS™)

The Process Guardian™ is a complete Raman spectroscopy system including a proprietary HTVS™-enabled spectrometer, a high-quality stabilized laser that is field replaceable, multiple laser safety interlocks, temperature monitoring and dynamic re-calibration, and automated system health monitoring and fault detection. Tornado's proprietary HTVS™ design eliminates spectrometer slit losses while maintaining high spectral resolution. This allows for the best possible combinations of signal strength and spectral resolution in a dispersive spectrometer and results in an order of magnitude improvement in sensitivity.

tornado spectral systems

Easy to Use Analyzer for Complex Processes

User Interface

The Process Guardian™ is a perfect Raman solution combining high-end performance with a multitude of ease-of-use features. Research scientists, process developers and production technicians can become proficient with the analyzer in no time. For at-line or in-line installations, the Process Guardian™ data acquisition can be configured via robust button and rotary dial controls. The buttons have been devised to be operated by users wearing gloves. Configuration menus, spectral plots, prediction results and process status are displayed on an integrated high-resolution 8.7" display. For benchtop use, the user can optionally attach a mouse/keyboard and external display.

The Process Guardian™ features an innovative LC duplex fiber optic cable connector. There is only one way to make a connection between cable and analyzer bulkhead, and insertion is a simple plug in and lock. The LC duplex connector has a built-in laser safety interlock mechanism: the laser will not emit unless the LC adapter has been fully inserted into the bulkhead receptor.

The analyzer features two independent LAN interfaces (separate network interface cards) facilitating secure remote access for general and dedicated SCADA control. Analytical results can be communicated via industry standard communication and remote access protocols externally via OPC UA or Modbus TCP. Alternatively, users can retrieve data via the instrument USB port.

But what really sets Process Guardian™ apart is its powerful embedded processor. No external computer needs to be supplied, approved or regularly maintained by plant IT services. It's a smart analyzer that can monitor its own health providing remote clients with status and alarms. An optional multichannel (4 or 8 channel) fiber switch is supported and is controlled directly by the instrument. The Process Guardian™ also supports connection to Tornado's OPIS 35™ ATEX/IECEx certified laser accessory for inherently safe <op is> Raman measurements in hazardous zones.

Superior Analytical Performance

The Process Guardian™ analytical performance is turbocharged by Tornado's patented HTVS™ technology. With enhanced photon collection power, higher SNR can be achieved leading to lower limits of detection without compromising spectral resolution. High precision on both the X and Y axes makes even the toughest chemometric modelling tasks achievable. With Process Guardian™ superior data, even debilitating fluorescent background noise can be overcome.

The high-quality data delivered by the Process Guardian™ can provide process information related to qualitative or quantitative chemical characterization with unsurpassed detection limits and specificity. This technological advantage delivers enhanced process understanding, which in turn leads to improved and optimized process control. This extends profitability and limits cost.

Probe Options for Broad Range of Applications

The Process Guardian™ is compatible with all of Tornado's standard Raman probe offerings, including:

- Non-contact for measurements through a sight glass for those processes that require minimized exposure
- Immersion bioprobes for upstream bioprocesses that require sanitary finishes and periodic probe sterilization
- Immersion probes for standard applications requiring contact sampling, such as monitoring chemical reactions
- Flow cell probes for monitoring downstream bioprocesses and flow chemistry scenarios

The Process Guardian™ is

Innovative - unique fiber optic cabling for reliable connection and built-in break detection

Intuitive - out of the box operation with simple navigation through user interface via fast action buttons and rotary dial entry

Reliable - allows the user to focus on their process and not worry about the accuracy or functionality of their analyzer

Compliant - supports 21 CFR Part 11 and GLP/GMP compliance

Compact - needing only 25 x 18 inches of bench space, and weighing less than 35 lbs., the Process Guardian™ is a versatile spectrometer for lab, field, and process solutions

Affordable - offers leading performance and value-added features at an attractive price

Technical Specifications

LASER WAVELENGTH	785 nm wavelength, Configurable power output from 5 to 495 mW; Output power stability $<\pm$ 1%
LASER POWER	20 mW up to 495 mW
SPECTRAL RANGE	200 cm^{-1} to 3300 cm^{-1} (Raman shift from 785 nm excitation)
FIBER OPTIC INTERCONNECT	LC Duplex (excitation/collection) Fiber break detection Dual interlock optional expansion
FIBER LENGTH	2 m standard - Different lengths available upon request
X-AXIS	Spectral Range: 200-3300 cm^{-1} Spectral Resolution: < 5 cm^{-1} (average across spectral range) Wavenumber Stability: $\pm$ 0.1 cm^{-1}
Y-AXIS	Dynamic Range: 45,000 counts (pre-calibration) Instrument Detection Limit: 4 counts (minimum acquisition 34ms, peak at 1001.4 cm^{-1})
COMMUNICATIONS	Dual Independent LAN (Gigabit Ethernet) OPC UA Modbus TCP
STANDALONE PREDICTION	SIMCA .usp PEAXACT .pxm Solo_Predictor .mat
USB EXPANSION ACCESSORIES	HDMI (external display) Dual USB (keyboard, mouse or accessory) 4 | 8 channel fiber switch (rack mountable) OPIS 35™ ATEX/IECEx certified laser (shelf mountable)
PROBES	Immersion and Non-Contact
ENVIRONMENTAL	Operating temp 0 °C to +35 °C Operating relative humidity $\leq$ 65% non-condensing
MOUNTING	Bench top or shelf mounting (19" rackmount compatible)
ELECTRICAL	100 V to 240 V AC line power; 60 W
DIMENSIONS	7.7 x 17.6 x 24.7 in (19.5 x 44.6 x 62.6 cm)
WEIGHT	33 lbs (15 kg)

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