NIRS Analyzer Pro

Nondestructive inline process analysis based on high-resolution diode array technology.

Metrohm
Process Analytics

Features and Benefits

- High resolution diode array technology for accurate and continuous analysis in reflectance or transflectance mode
- Quick and simple implementation of the analyzer
- Easily transfer models between NIRS Analyzer Pro systems
- Uptime protection with dual lamp technology for low maintenance, provides seamless accuracy when automatically switched to the pre-standardized second lamp
- Dedicated sample interfaces provide accuracy and rapid implementation
- Instant measurement of complete wavelength range for direct measurement of liquids and solids, also suitable for fast moving, uneven samples
- Quantitative and qualitative data for better inline process control
- Vision software is available in a fully validatable pharmaceutical version which is FDA 21 CFR Part 11 compliant
- Fulfills the regulations of the Process Analytical Technology (PAT) initiative of the FDA as well as Quality by Design (QbD) tenets
- Integrated diagnostics with Metrohm calibration tool, Vision enables simple and reliable calibration setup
- Metrohm supports several interfaces for integration to local control systems, enabling automatic regulation of the process

NIRS Analyzer Pro is a process analysis system based on high resolution diode array technology. It provides non-destructive analysis of liquids, granules, powders, slurries or opaque samples directly in the process line without bypass – a true inline system.

The analyzer can be housed in a robust cabinet mounted at the relevant location in the production area. Measurements are displayed in the control room and results can be fed into a regulation system for closed-loop automatic control.

The solution helps to optimize the use of raw materials and to consistently run production closer to target specifications. For pharmaceutical manufacturers, the NIRS Analyzer Pro is a valuable PAT tool, allowing you to increase throughput and maximize on QbD (Quality by Design). The Vision software is also available in a fully validatable pharmaceutical version which is FDA 21 CFR Part 11 compliant.

Precise instrument matching enhances method development, minimizes implementation efforts and ensures calibration model transferability between analyzers.

System Description

The NIRS Analyzer Pro process analyzer is available with dedicated interfaces based on reflectance or transflectance technology whichever is best suited for each application area. Measurements are done directly on the moving sample in the process stream. A high-intensity dual lamp light source illuminates the sample directly or through an optical fiber. The light interacts with the sample and the reflected or transmitted light is measured by the diode array sensor. The pre-standardized lamps in the dual lamp system secure uptime and analytical accuracy remains unchanged even after switching to a new lamp. Lamp switching is done automatically without any need for operator intervention.

The complete wavelength range (1100–1650 nm) is measured instantaneously, which also enables highly accurate measurements on fast moving samples. Calibrations are transferable between units ensuring easy expansion to other measurement points. Integration to process regulations systems can be done through multiple interfaces.

Dedicated sample interfaces

Window reflectance (Contact Reflection)

Inline analysis of solids, granulates, powders, and other similar products in pipes or transport systems without bypass can be performed. The products pass over the interface window. The window reflection interface can easily be installed into the production line using standard industry flowcells or welding an interface flange into the wall of the pipe/transport system. The analyzer can be set up to scan through a process window if absolutely no contact with the process is allowed.

Temperature	Max 150 °C (302 °F)
Pressure	Max Vacuum > 1 torr (0.02 PSI) Max Pressure < 3000 PSI
Lens	Sapphire; Diameter 45 mm, thickness 12 mm, with high quality EPDM O-ring seal

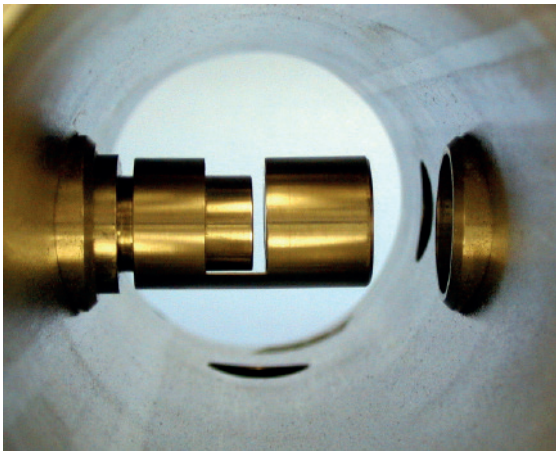
Direct light (Non-Contact)

Inline analysis of products where direct contact with the product is not a technically feasible solution i.e. product transported on a conveyer belt. Uneven surfaces are able to be analyzed easily, such as in the determination of tree species in the pulp and paper industry or sorting fiber blends in the textile industry.

Lens	Sapphire; Diameter 45 mm, thickness 12 mm, with high quality EPDM O-ring seal
Distance	100–250 mm to sample surface
Scanning area	20–85 mm Ø

Transflectance measurements (Fiber System)
Inline analysis of clear to scattering liquids and slurries (less than 15% solids) is possible using the properties of transflectance and the micro interactance immersion probe. The probe consists of a probe body and an adjustable high-energy mirror tip. The sample flows through the gap between the probe body and mirror tip, and adjusting the mirror tip defines the pathlength (equal to two times the gap) for analysis. This probe can be installed directly into the process line or reactor, or into a side-stream loop. Fixed pathlength immersion probes are also available.

Material	SS 316L, Hastelloy, Other materials also available
Diameter	Customizable, from 12.7 mm (0.5 in)
Length	Customizable, from 305 mm (12 in)
Optical Fiber	Microbundle ultra-low OH fiber (maximum 75 meters)
Temperature	Max 120 °C (248 °F)
Pressure	Max Pressure < 5000 PSI
Installation	Compression fitting, Welded flange, Other options also available



Reflectance of powders (Fiber System)
Inline analysis of fine powder, such as in the manufacture of pharmaceuticals, can be performed with the micro interactance reflectance probe with purge on collection tip (powder probe). The powder probe interface can easily be installed into a hopper, fluid bed dryer, reactor, or pipe with free falling product. The powder collects at the end of the probe for analysis. The probe has no moving parts and is automatically cleaned with compressed air or nitrogen prior to each analysis. Additionally, the powder probe can be created from Teflon in the case of sticky powders.

Material	SS 316L, Teflon (PTFE), Hastelloy, Other materials also available
Diameter	25.4 mm (1 in)
Length	Customizable, from 305 mm (12 in)
Optical Fiber	Microbundle ultra-low OH fiber (maximum 75 meters)
Purging	Clean compressed air 43–72 PSI, or Nitrogen
Temperature	Max 120 °C (248 °F)
Installation	Compression fitting, Welded flange, Other options also available

Other Fiber Probes
An assortment of reflectance probes is available for other types of samples and process situations. The sizes and materials can be changed depending on the process and requirements.

- Micro Interactance Reflectance Probe
- Optimized Micro Reflectance (45 degree) Probe

Standards and approvals

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NIRS Analyzer Pro is CE labeled and complies with the following directives:

- Low Voltage Directive (LVD) (2006/95/EC)
- RoHS Directive (2002/95/EC)
- Packaging and packing and waste Directive (94/62/EC)
- WEEE Directive (2002/96/EC)
- IECEx, Zone 20 (IEC 61241-1-2004 – Explosion safety for DUST-Protection by enclosure tD)
- REACH Directive (1907/2006/EC)
- Developed and produced according to Metrohm ISO approval ISO 9001

Technical Specifications

NIRS Analyzer Pro Reflection	
Analysis time	5–50 ms / integration time; Average time per result 1–15 seconds
Measurement mode	Reflectance (Window reflectance; Direct Light, Powder Probe)
Wavelength range	1100–1650 nm
Detector	InGaAs Diode array
Spectral dispersion	1.1 nm / pixel

NIRS Analyzer Pro Transflectance	
Analysis time	5–50 ms / integration time; Average time per result 1–15 seconds
Measurement mode	Transflectance (Immersion Probe)
Wavelength range	1100–1650 nm
Detector	InGaAs Diode array
Spectral dispersion	1.1 nm / pixel

General (Typical performance under normal operating conditions)	
Light source lifetime	Dual lamp system MTBF = 17'500 h
Software package	Vision for instrument control and method development Fully validatable pharmaceutical version is FDA 21 CFR Part 11 compliant
Wavelength accuracy	0.5 nm
Wavelength precision	< 0.02 nm
Wavelength stability	< 0.01 nm/°C
Noise	< 60 micro AU
Random Vibrations	0.4 grms at 10–150 Hz according to IEC 60068-2-64 0.4 grms at 10–1250 Hz according to Metrohm internal standard (more information available on request)
Temperature	-5–40 °C (23–104 °F). With purge -5–65 °C (23–149 °F)
Purge air	Flow rate minimum 5 L/min, > 99.99% water free, > 99.9% free of oil and fine particles down to 0.3 µm
Ambient humidity	10–90% relative (non-condensing)
Dimensions (w × h × d)	42 × 42 × 13.5 cm (16.5 × 16.5 × 5.3 inches) + brackets to hold the unit
Weight	25 kg / 55 lbs
Cabinet	1.5 mm (lid 2.5 mm) Stainless Steel EN 1.4301 (SS2333)
Protection	IP69K[1)] according to IEC 60529 and DIN 40050 part 9, NT ELEC 023
Communication	4–20 mA, OPC, Modbus, Profibus
Power supply	Recommended isolated or conditioned line power 100–240 VAC, 50–60 Hz, 2.0 A, 150 W

[1)] IP6x is the highest protection for dust entering the unit. IPx9K means protected against the effect of high-pressure water and/or steam cleaning at high temperature.

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Subject to modifications
Layout by Ecknauer+Schoch ASW, printed in Switzerland by Metrohm AG, CH-9100 Herisau
8.928.5000EN – 2016-05

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