



EIE

**Online NMR Analysis System
EIE-CN60-2**

Online NMR Analysis System



- The online nuclear magnetic resonance analyzer can analyze crude oil, naphtha, aviation kerosene, diesel fuel, wax oil, residual oil, edible oil, and chemical raw materials, providing relevant data rapidly within 6–8 minutes.
- ASTM D3701-23: Determination of hydrogen content in aviation turbine fuels using low-resolution NMR spectroscopy
- ASTM D4808-23: Determination of hydrogen content in light/middle fractions, gas oil, and residual oil using low-resolution NMR
- ASTM D7171-20: Determination of hydrogen content in middle fractions using low-resolution pulsed NMR
- Simulation Standards: ASTM D 3764/D6122/D1655/D6299
- Safety Certification: ATEX II 2 G; Ex II T4
- A single instrument and one scan complete multiple parameter analyses.
- Fully automated analysis with no human intervention required
- Can analyze opaque, colored, and various water-containing materials.
- It enables real-time monitoring of changes in material properties and allows timely adjustment of processing parameters.



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Introduction

The online nuclear magnetic resonance (NMR) analyzer is specifically designed for continuous detection and analysis of the composition of process media. Utilizing NMR analytical techniques, it can identify the presence, composition, and concentration of chemical components in process materials. When combined with appropriate software, it provides data support for ensuring stable operation of production facilities, offering broad application prospects.



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Technical Features

- Real-time, continuous analysis of sample properties
- It enables real-time monitoring of changes in sample properties and allows timely adjustment of processing protocols.
- Reduce the response time of laboratory analyses and enable stricter quality control,
- Capable of analyzing dark, viscous, and opaque liquid samples.
- Direct measurement of molecules; direct analysis of key physical properties
- Full-spectrum linear response: intelligent model, automatic calibration, automatic upgrade, precise measurement
- Multi-parameter, direct analysis that replaces traditional analytical instruments, delivering rapid analytical results and providing highly precise data for precise control with excellent reproducibility and repeatability.
- The sample preparation is simple and does not require dehydration.
- Easy to maintain
- Obtain a comprehensive understanding of material quality throughout the entire refinery process, and issue targeted production guidelines for the entire facility.

No.	Material	Range of measurable physical properties
1	Crude oil	API, acid value, total carbon, total hydrogen, total sulfur, total nitrogen, moisture content, freezing point, residual carbon, resins, asphaltenes, solid boiling point yield, nickel content, vanadium content, etc.
2	Naphtha	Distillation range, density, octane number, PONA, sulfur content, nitrogen content, bromine value, vapor pressure, etc.
3	Jet fuel	Distillation range, density, viscosity, sulfur content, flash point, smoke point, freezing point, aniline point, composition, etc.
4	Diesel fuel	Density, viscosity, cetane number, distillation range, flash point, freezing point, sulfur content, nitrogen content, etc.
5	Wax oil (VGO)	Density, boiling range, viscosity, residual carbon, basic nitrogen, C, H, S, N, flash point, freezing point, etc.



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6	Residual oil	Density, boiling range, viscosity, residual carbon, C, H, S, N, Ni, V, flash point, freezing point, four components, etc.
7	Edible oil	Acid value, peroxide value, moisture content, phospholipids, residual solubility, soap content, color, etc.
8	Chemical feedstocks	Concentrations of cyclohexane, cyclohexanone, cyclohexanol, etc.

NMR online analyzer, supporting software, preprocessing system, and analysis cabin are all provided uniformly.;

Physical Property Model: Users are required to provide 20 representative sample sets along with corresponding experimental analysis data for model validation.;

Engineering Design: Collaborate with the design institute on engineering design and on-site implementation.



Sample pretreatment system



Multi-logistics switching system



Online NMR Analysis System



Analysis Hut

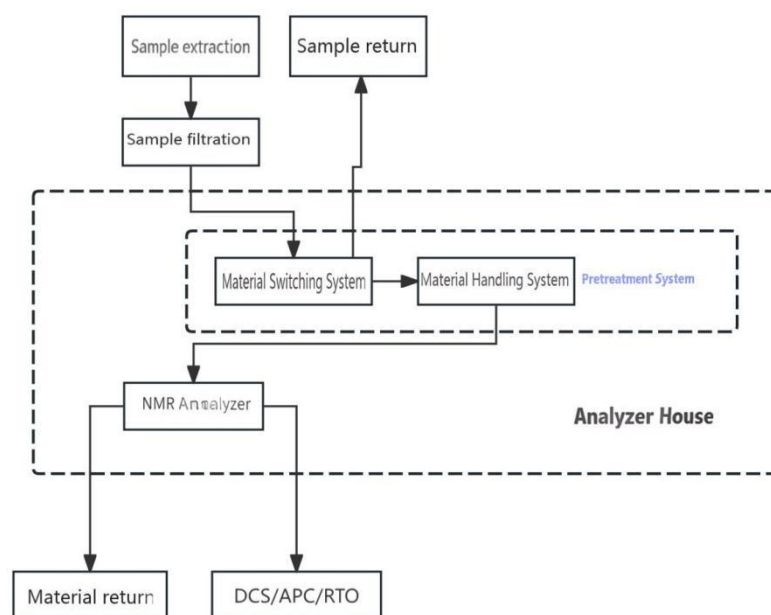


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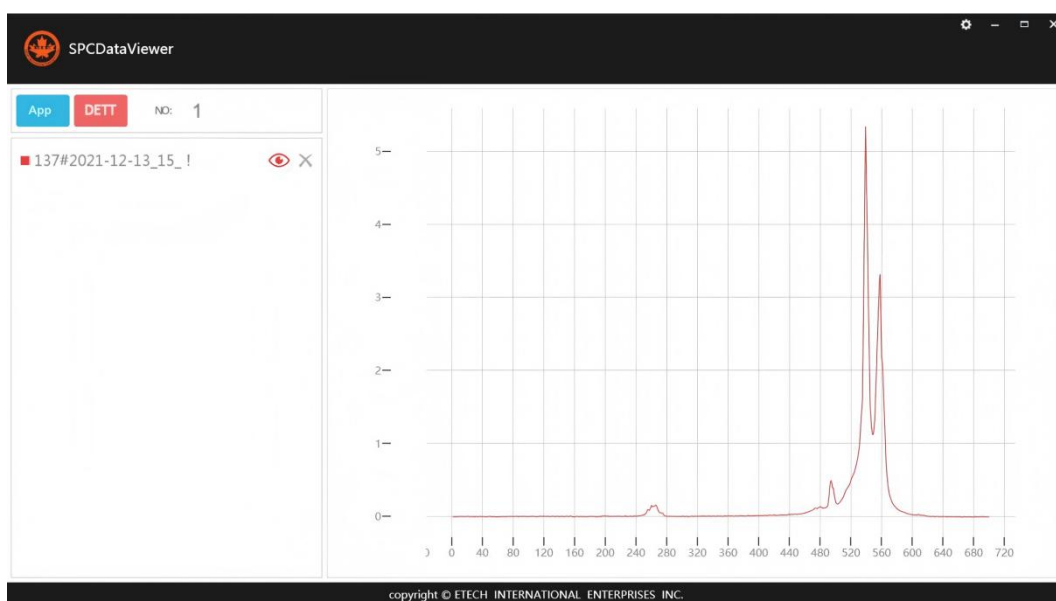
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The sample online NMR analysis system can simultaneously perform cyclic analysis on two samples, with each sample analysis lasting approximately 6 – 8 minutes. The analysis results for each sample are updated approximately every 12 minutes.

The entire process is fully automated and requires no human intervention.



Nuclear Magnetic Analysis Flowchart



Nuclear
magnetic
resonance
analysis
spectrum

The online magnetic resonance imaging (MRI) analysis instrument is assembled in compliance with the highest safety requirements of petrochemical enterprises. Its

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analytical system features a compact size and can be integrated into an analytical cabin.

Online nuclear magnetic resonance (NMR) analysis instruments include: single-channel NMR main analyzers, industrial PCs, communication software, and user interface software packages.

The analytical instrument is housed within an instrument cabinet meeting NEMA4/IP56 protection standards, with the system designed for explosion-proof applications in Zone 2 G IIA, IIB, and IIC environments.

System Standard Performance Parameters	
Observation nucleus	H1 supports: C13, F19, P31
Operating Frequency	60±0.5MHz
NMR probe	Environmental temperature probe, 8 mm (available in sizes up to 10 mm)
Operating Ambient Temperature	With air conditioning, the temperature should be maintained between 20°C and 30°C, with allowable temperature fluctuations <5°C.
ambient humidity	<70%
Proton Resolution	Non-uniform field: Half-maximum height less than 500 Hz; 10% peak height less than 1000 Hz
	Uniformity: Half-maximum height less than 6 Hz; 10% peak height less than 24 Hz
Proton Line Shape	Average peak height width of C13 satellite peak (0.55%): <80 Hz
Proton sensitivity	A single pulse is sufficient to observe the maximum peak signal of 10% ethylbenzene's quadruple peak, with a signal-to-noise ratio of 25:1; data acquisition requires one pulse.
Proton signal average	Sixteen pulse data acquisitions were sufficient to observe the maximum peak signal of the 10% ethylbenzene quadruplet, with an average signal-to-noise ratio of 125:1.
Pulse Width	7 watts of RF power, pulse width with a transmission flip angle of 90 degrees, less than 30 microseconds
Fractional Ratio	A 10% ethylbenzene solution by volume, with three distinct chemical groups identified in the NMR spectrum.
	Accuracy: The average ratio between the two groups in ethylbenzene (the benzene ring to CH ₂ +CH ₃) is 1:1 ± 0.05.
	Accuracy: The standard deviation of ten consecutive integrations does not exceed 0.01

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Magnet System	
System	Stable self-compressing permanent magnet with computer-controlled magnetic field homogenizing coil
Magnetic Field Strength	45°C 1.42T
Edge field strength	The magnetic field strength inside the magnet housing is less than 1 Gauss.
Characteristic	
test method	NMR Spectrum
Measurement Method	Chemometrics
sample treatment	Depends on the specific application
Infiltrating material	Ceramic Tube
Communication	Modbus RS485, TCP/IP
Physical dimensions and weight	
Size	On-site analysis cabin dimensions: 5600×2600×3100 mm; NMR online analyzer dimensions: 1100×76×1960 mm; sample processing system dimensions: 1200×600×2100 mm; multi-stream switching system dimensions: 2400×600×2000 mm.
Weight	650 kg
energy consumption	20 kW, three-phase, four-wire system, 380 V
Environmental Conditions	
Operating Conditions	20°C to 30°C, temperature fluctuation less than 5°C
Relative Humidity	30% ~ 70% (no condensation)
Storage Temperature	0°C to +55°C