

Process Analytical System for Pyrolysis Products Analysis

Our priorities

- Performance
- Reliability
- Flexibility
- Convenience
- Cost-efficiency

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The automated process analytical system based on gas chromatography is designed for online measurement and control of pyrolysis process.

The system provides continuous automatic analysis of gaseous products of pyrolysis and calculation of its physical and chemical properties.

Key benefits

- ✓ Accurate analysis of gaseous pyrolysis products
- ✓ Determination of H₂O and H₂S concentration in gas
- ✓ Advanced Calorific value and Methane number calculation algorithm based on fuel specs of the leading gas engine manufacturers
- ✓ Fast and accurate analysis for online process control, gas mixing and averaging, allowing most efficient fuel consumption in pyrolysis power generation
- ✓ Automatic analysis of up to 6 gaseous streams according to preset sequence
- ✓ Opportunity of manual injection and analysis of samples
- ✓ Variety of the data transmitting interfaces
- ✓ Custom-built WEB-based software for remote access, settings and data acquisition
- ✓ Large LCD touch screen with user-friendly interface for easy control and interaction with the system
- ✓ Advanced sample conditioning system for various pyrolysis products
- ✓ Digital pressure sensors for carrier gas help to replace cylinders on time
- ✓ Low operating and maintenance cost owing to low power and gas consumption



CONFIGURATION FEATURES

Modular configuration

Pyrolysis Products Analysis System consists of 3 parts:

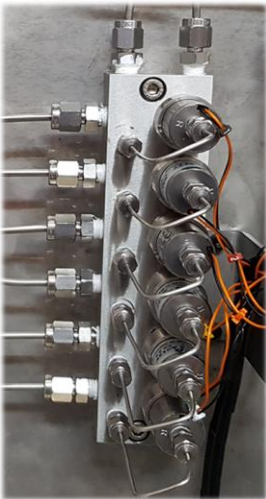
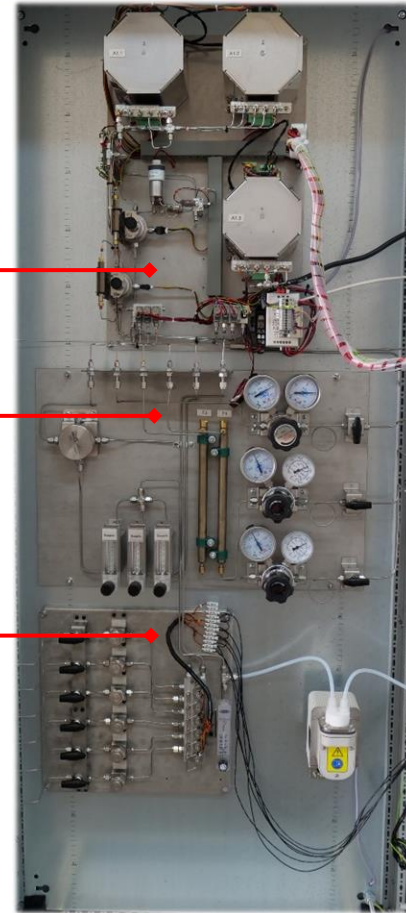
- ✓ Process Gas Chromatograph MAG
- ✓ Sample Conditioning System
- ✓ Stream Switching System

Process Gas Chromatograph

- ✓ Contains three analytical channels with TCD used for parallel analysis of gaseous sample. Flexible modular configuration of the system allows to equip it with additional modules for extended analysis.
- ✓ Includes the electrochemical sensor for precise measurement of **oxygen** content of pyrolysis gas.



Analytical
GC channel



Sample switching valves

Sample conditioning system

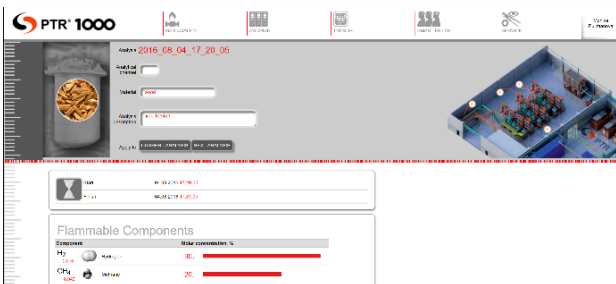
Used for the sample intake by pump, separation of the water from the gaseous sample, filtration, bypass purging, delivering the sample into the Gas Chromatograph and forwarding the sample to the waste.

Stream Switching System

The Stream Switching System is equipped with **6 solenoid valves** for automated switching and selection of analyzed gas stream supplied to the analytical system according to preset sequence.

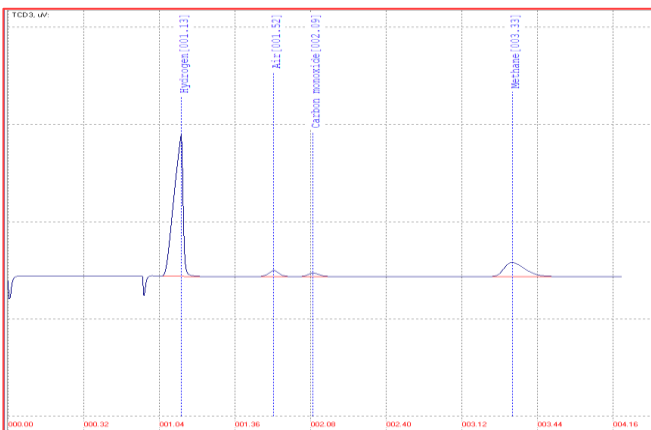
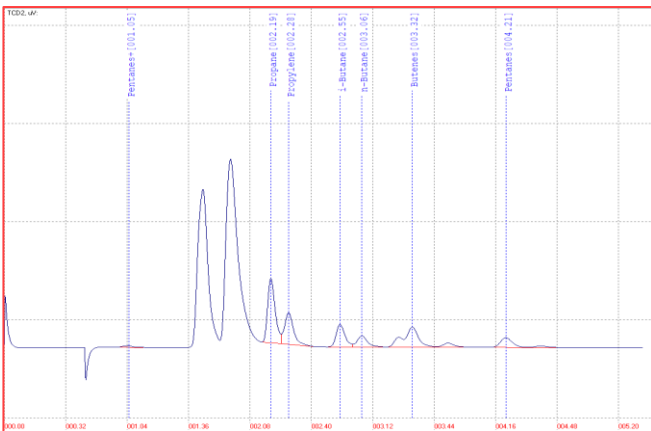
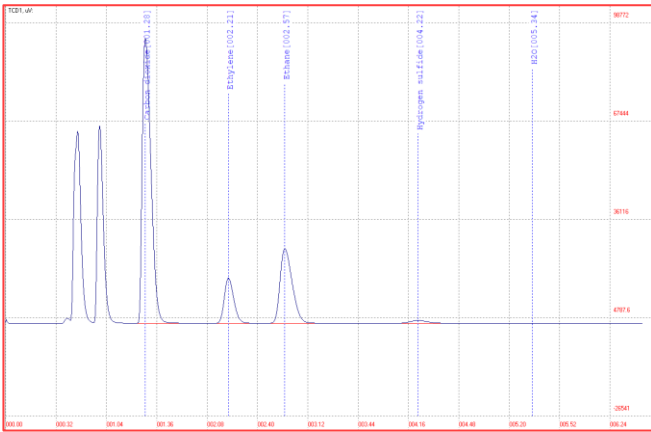
Web interface

- ✓ Cloud-based storage of analysis reports and trends
- ✓ Secure web-authorization
- ✓ Multiple users, multi-level access
- ✓ XML-based remote data storage
- ✓ Accessible from any mobile device
- ✓ SMART Rules for operation and maintenance



APPLICATION DETAILS

Online analysis of composition of gaseous products of pyrolysis process followed by calculation of its **physicochemical properties** including water dew point, calorific values, relative and absolute density, compressibility factor and Wobbe index in accordance with **ISO 6976** and methane number using an SAE based Methane Number (MN) calculation (SAE 922359 Eqn. 4) by Cummins Westport.



Chromatograms of pyrolysis gas analysis

Analyzed Components and Detection Ranges

H ₂ 2.016		Hydrogen	0.1 – 50%
CH ₄ 16.042		Methane	0.005 – 50%
N ₂ 28.02		Nitrogen	0.01 – 50%
O ₂ 32.00		Oxygen	0.01 – 50%
CO 28.01		Carbon monoxide	0.01 – 50%
CO ₂ 44.01		Carbon dioxide	0.005 – 60%
C ₂ H ₂ 26.04		Acetylene	0.005 – 50%
C ₂ H ₄ 28.052		Ethylene	0.005 – 50%
C ₂ H ₆ 30.068		Ethane	0.005 – 50%
H ₂ S 34.076		Hydrogen sulfide	0.005 – 10%
H ₂ O 18.016		Water	0.01 – 10%
C ₃ H ₆ 42.078		Propylene	0.005 – 50%
C ₃ H ₈ 44.094		Propane	0.005 – 50%
C ₄ H ₈ 56.104		Butenes	0.005 – 50%
C ₄ H ₁₀ 58.12		i-Butane	0.005 – 50%
C ₄ H ₁₀ 58.12		n-Butane	0.005 – 50%
C ₅₊ >60.05		Pentanes+	0.005 – 50%

SPECIFICATION

Technical characteristics	
Number of the analytical GC channels	3
Type of detector	Thermal conductivity detector (TCD) Electrochemical oxygen sensor
Carrier gas types	Helium, not worse than 4.5 Grade (99,995%) Argon, not worse than 4.5 Grade (99,995%)
Carrier gas consumption	Helium: 16 sccm (total) Argon: 9,5 sccm
Oven type	Airless, isothermal
Type of chromatograph columns	micropacked
Carrier gas pressure regulator	Mechanical, 2 pcs.
Number of analyzed streams	up to 6
Analysis time	No more than 9:00 min
Chromatograph calibration	Automatic (by test gas mixture)
Data input-output device	12" LCD sensor display
Communication interfaces	RS 485 (ModbusRTU) – 1 pcs., Ethernet (ModbusTCP/) – 1 pc., Discrete inputs (NAMUR) – 4 pcs.
Power voltage	220V and with frequency (50±1) Hz
Power consumption	at the warm-up – not more than 570 W; after the warm-up – not more than 80W.
Ingress Protection Marking	IP65 as per IEC 60529:2013
Ambient conditions	from -10 to +50 °C at atmospheric pressure 84.0-106.7 kPa, at atmosphere relative humidity not more than 95% without humidity condensation
Dimensions (length×width×height)	800×400×1800 mm
Weight	Not more than 100 kg

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