



A SCENT OF FUTURE

Master GC

TURN-KEY ANALYZERS

SUPERIOR PETROCHEMICAL SOLUTIONS

BROAD ARRAY OF CONFIGURATIONS FOR SPECIAL APPLICATIONS

THE PERFECT ANSWER TO A SEVERELY REGULATED MARKET

DATA AT HAND WITH THE POWERFUL SOFTWARE



Master GC
TURN-KEY ANALYZERS

Master GC Turn-Key Analyzer for Superior Petrochemical Solutions

The ability to provide the appropriate GC system to meet the most challenging analytical demands comes from a proven gas chromatographic experience and deep industry knowledge.

As requirements change a highly reliable instrumentation could not be enough to succeed in getting trustworthy results: complete and guaranteed solutions are essential to comply with the latest industry standards and specifications.

In this view, and after a close work with its customers to best match their real needs, DANI Instruments has developed key analytical solutions that cover a broadest array of applications, requirements and protocols in petrochemical, energy and fuels industries.

Master GC Turn-Key Analyzers are pre-configured, fully integrated, tested and guaranteed solutions able to meet today's analytical laboratories needs, be they simple or highly complex.

Instrumentation, applications, supplies, services and data handling: Master GC Turn-Key Analyzer are completely tailored gas chromatography solutions.

Master GC Turn-Key Analyzers features:

- Robust and reliable systems
- Breakthrough analytical capabilities
- High quality
- Reduced analysis time
- High return of investment
- Rapid installation and ease of use



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Master

Extended Flexibility and Upgradeability: a Broad Array of Configurations for Special Applications

Master GC Turn-Key Analyzers are based on DANI Master GC Gas Chromatograph, the most suitable gas chromatograph for the development of complex analytical systems. The highest degree of flexibility and upgradeability featured by Master GC easily support an array of custom configurations: from the retrofit of a single gas sampling valve and a packed column to five-valve three-channel system with multiple columns. The instrument can be equipped to cover the whole spectrum of laboratory needs from the simplest to the most challenging petrochemical analyses.

- Up to three injectors and three detectors simultaneously.
- Set up of two auxiliary temperatures.
- Up to five auxiliary pressures (one settable as auxiliary flow).



Specific petrochemical applications require some components to be analyzed at isothermal temperature. In these cases a side-mounted oven is necessary to house all valves and pneumatics for both liquid and gas sampling. GC column oven, on the other hand, performs temperature program analysis.

Master GC can be equipped with an auxiliary oven for isothermal temperature. Two models of these ovens are available with different capacities to house valves and columns for dedicated analyses.



Aux Oven	High Capacity Aux Oven
- Up to three valves	- Up to 7 valves (5 gas + 2 liquid)
- Up to 250°C	- Up to 250°C
- Extremely Compact Design	- Up to 2 auxiliary gas lines
- Liquid Valve on GC	- Up to 6 needle valves



The Heart of the System

Intuitive and easy to use, the touchscreen interface combines functionality with simplicity, offering instrument control through self-explanatory icons and windows for quick operations.

A complete range of Injectors:

- Split/Splitless Injector
- Programmable Temperature Vaporizer (PTV)
- Packed Injector

Wide selection of Detectors:

- Flame Ionization Detector (FID)
- Electron Capture Detector (ECD)
- Nitrogen-Phosphorus Detector (NPD)
- Flame Photometric Detector (FPD)
- Thermal Conductivity Detector (TCD)
- Pulse Discharge Detector (PDD)
- Master TOF-MS Time of Flight Mass Spectrometer

An extensive choice of dedicated devices:

- Auxiliary ovens
- Gas sampling and switching valves
- Liquid sampling valves
- GC oven cryogenic cooling device
- Methanizer

The Best Sample Introduction System to Meet any analytical requirement.

DANI Instruments provides a wide range of Sample Introduction Systems for any GC to increase productivity, enhance sensitivity and reduce analysis costs.



Master AS

- Superior flexibility, repeatability and performances
- Increased sample throughput
- Enhanced productivity

Master SHS – Static Headspace Sampler

- A robust and flexible system to meet complex and versatile needs
- Reliable results and exceptional reproducibility
- Intuitive, powerful and straightforward user interface



Natural and Refinery Gas Analyzers

The commercial value of natural gas is based on its energy content; hence, composition analysis is strictly required to establish the heating value and BTU content.

Master NGA Analyzer provides an innovative three-channel analysis to fulfill the demand of strict quality control routines.

Master RGA Analyzer is the three-channel solution able to determine individual components from the very complex gas streams produced in refinery process.

Master NGA features:

Based on micropacked columns - PLOT Q and Molsieve 5A- channels 1 and 2 use a TCD: channel 1 uses helium as carrier gas for the detection of permanent gases and channel 2 uses nitrogen to enable the detection of helium and hydrogen.

On channel 3 hydrocarbons from C1 to C7 (or higher) are separated on a PLOT alumina column connected to an FID.

Sample injection is made through a 10-port sampling valve, while two 6-port valves are housed in the High Capacity Auxiliary Oven to switch between the columns.

The efficient sampling technique allows protecting the Molsieve 5A columns, therefore ensuring a long analytical column life-time and highly reliable analytical results.

The use of a μ TCD not only provides an advantageous increase in sensitivity, when compared to a conventional TCD, but also eliminates considerable carrier gas costs.

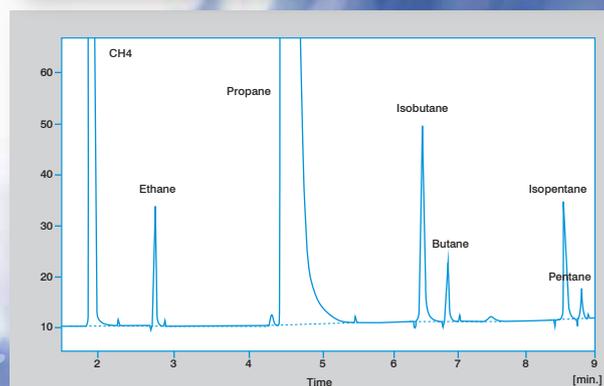
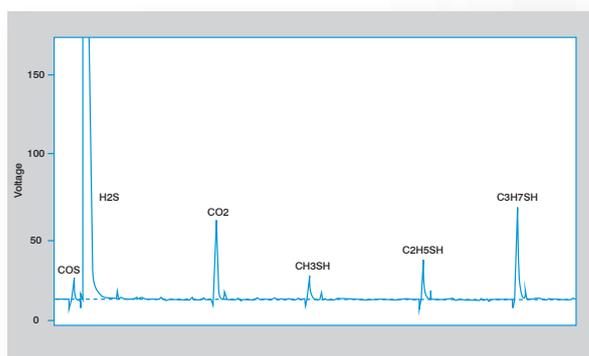
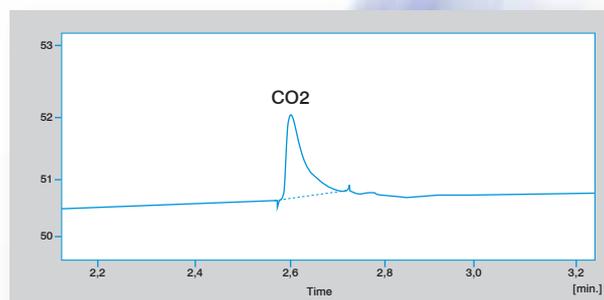
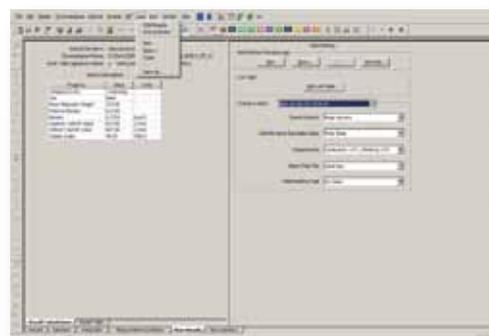
The novel three-channel method meets the specifications of the ASTM 1945, ISO 6974, ISO 6975, and UOP 539 regulations.

Gas properties calculations are automatically performed according to the selected norm by the NGA Extension of the Clarity™ software.



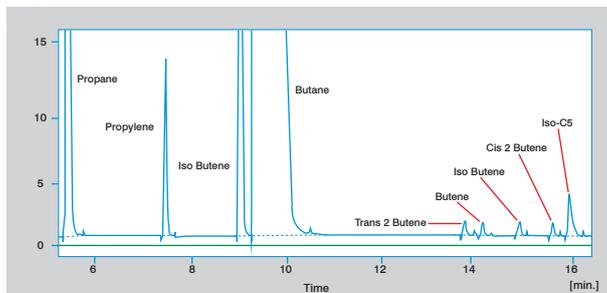
NGA Software Extension

NGA extension is a software module for Natural Gas and Liquefied Petroleum Gas Data processing. You no longer need an external tool for gas properties calculations since the Clarity contains the complete workflow of data acquisition, peak calibration, gas properties calculations based on the key ASTM, ISO and GPA norms.



Liquid Petroleum Gas (LPG) Analyzer

The hydrocarbon composition of liquefied petroleum gas, derived either from petroleum refining or natural gas processing, and of propene mixtures has to be accurately determined to ensure their uniform quality. As it is well-known, LPG is mainly composed of C3 and C4 with single and double bonds, such as propane, butane, propylene, and butylene.



The complete separation of the mixture is carried out on a suitable column. Additionally, in order to introduce a representative sample of the LPG composition, the system is configured with an external two-position valve for liquid sampling, overcoming the components' different vapor pressure.

Detailed Hydrocarbon Analyzer [DHA]

DANI Instruments provides a complete gas chromatographic solution for the analysis of hydrocarbons in petroleum streams, capable of performing all of the standard methods including the analysis of light petroleum streams and crude oil light end.

Detailed hydrocarbon analysis is often the preferred technique to fully characterize petroleum streams. The technique is based on the identification of individual components using high performance and high resolution capillary gas chromatography. DHA solution is compliant with the following methods:

ASTM D6729
ASTM D6730
ASTM D6733
ASTM D5134

The DHA solution is configured, tested and certified at the factory for the standard method specified by the customer.

DHA Software Extension is supplied for detailed hydrocarbon analyses reporting.



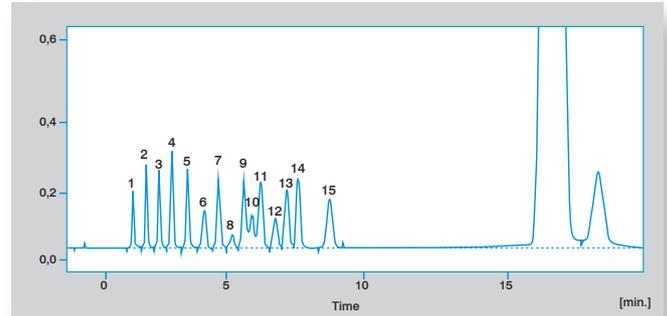
Determination of Oxygenates and Aromatics in Gasoline

ASTM D4815 Method

Oxygenated and aromatics compounds are commonly added to gasoline as anti-knock agents to increase the octane number and decrease emissions by replacing organo-lead compounds.

U.S. EPA has specified a minimum of 2% O₂ by weight (w/w) in gasoline as an attempt to reduce automobile emissions and improve air quality in polluted areas. MTBE is the most widely applied oxygenate and a gasoline concentration of about 12 w/w % MTBE already meets the 2 w/w % requirement.

Gas Chromatography is the most used approach for the analysis of oxygenates in gasoline and the **ASTM D4815 method**, in particular, proposes the use of a multi-column chromatographic system.



1. Methanol, 2. Ethanol, 3. Isopropanol, 4. t-Butanol, 5. n-Propanol, 6. MTBE, 7. sec-Butanol, 8. DIPE, 9. Isobutanol, 10. ETBE, 11. Ter-amyl alcohol, 12. DME, 13. n-Butanol, 13. Benzene, 14. TAME

ASTM D5580 Method

Benzene and aromatics are classified as carcinogens. Regulations limiting their concentration in finished gasoline are established worldwide.

ASTM 5580 method covers the determination of benzene, toluene, ethylbenzene, xylenes, C₉ and heavier aromatics, and total aromatics in finished motor gasoline by gas chromatography.

Master GC for Aromatics in Gasoline is a two-column chromatographic system equipped with a column switching valve and an FID.

A reproducible volume of sample containing an appropriate IS such as 2-hexanone is injected onto a precolumn containing a polar liquid phase TCEP.

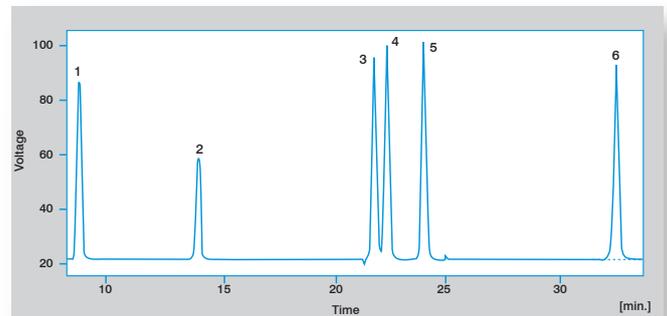
The TCEP precolumn is backflushed immediately before the elution of benzene, and the remaining portion of the sample is directed onto a second column containing a nonpolar liquid phase.

Benzene, toluene eluted in the order of their boiling points are then detected by FID.

Immediately after the elution of the IS the flow through the nonpolar WCOT column is reversed to backflush the remaining of the sample from the column to the FID.

Master GC for Oxygenates in Gasoline is composed of a MASTER GC equipped with two columns, a switching valve, and an FID. At first the injected sample passes onto a polar TCEP column, to retain oxygenates and heavy hydrocarbons, while lighter hydrocarbons elute to the vent. The retained components are then backflushed into a non-polar column enabling the separation of alcohols and ethers.

Type and concentration of target ethers (MTBE, DIPE, ETBE and TAME) and alcohols (C₁–C₄ alcohols and tert-pentanol) are specified to ensure acceptable commercial gasoline quality. The system fully meets specifications given in the ASTM D4815 method.



1. Benzene, 2. Toluene, 3. Ethyl benzene, 4. Xileni, 5. xileni, 6. 1, 2, 3 Tri methyl benzene

Simulated Distillation [SIMDIST] Analyzer

Simulated Distillation (SimDist) reproduces the physical distillation of petroleum materials and products by determining boiling point distribution.

Samples are analyzed on a non polar chromatographic column that separates the hydrocarbons according to their boiling points. These are correlated with the retention times, through a calibration curve obtained by running under the same conditions a known mixture of hydrocarbons, usually n-alkanes, covering the boiling range expected in the sample.

Results are reported as a correlation between the boiling points and the percentages of the sample eluted from the column.

Used for controlling refinery operations, SimDist analyzer delivers fast, accurate standard test method results.



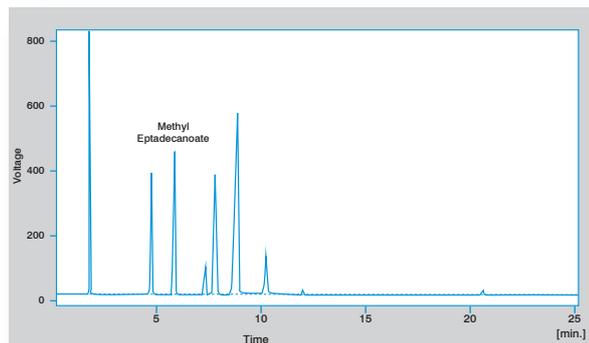
Biodiesel Monitoring

Biodiesel, as an alternative to petroleum-diesel fuel, is receiving worldwide attention. The biofuel is mainly obtained from oil crops, such as rapeseed, palm, soybean, and sunflower, although waste oils from cooking and animal fats can also be used. Origin and quality level of the fuel sample have to be continuously monitored for its best characterization. Additionally, biodiesel can consist of up to hundred different FAMES, depending on the plants oils used for the production. Biodiesel composition has to meet the specifications given in the DIN EN 14214 in Europe and ASTM D6751 in U.S.A., which specify all legal limits for possible by-products. EN 14105 sets the standards to determine free and total glycerol and glycerol esters in biodiesel oil, while EN 14110 describes the required method for methanol determination. As biodiesel must consist of 90 % (m/m) or more of FAMES within the range of C14:0 up to C24:1, the EN 14103 method establishes how to determine the ester content of FAMES and amount of linolenic acid methyl ester.

Master Biodiesel Analyzer combines the four methods in a single versatile unit. The Master GC, equipped with two SL/INs and a PTV, three FIDs and a Master AS Liquid Autosampler, is hyphenated to Master SHS Static Headspace Sampler. Total glycerol and glycerol esters analysis is carried out in the PTV channel, whereas ester content of FAMES and linolenic acid methyl ester determinations are performed in the SL/IN channel.

The analysis of the methanol uses the Static Headspace Sampler to extract the low-boiling point methanol from the sample.

Master SHS Static Headspace Sampler applies the Valve & Loop technique, which is a renowned and proven headspace sampling mode able to merge robustness with reliability. All the analyses are performed on DN-BioDiesel proper columns for best analytical results.



Transformer-Oil Gas Analysis [TOGA] Analyzer

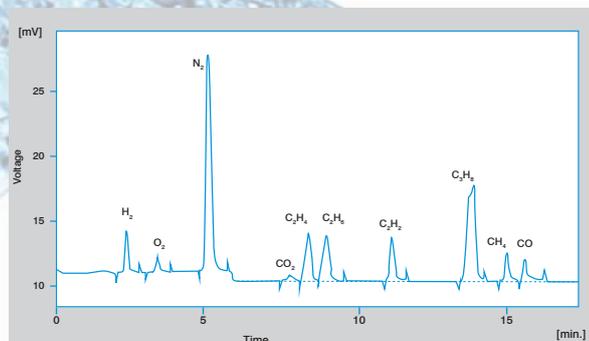
Transformer-oil gas analysis (TOGA) is required as a test of oil-filled electrical transformers condition. When a fault in a transformer occurs, certain gaseous products appear. The relationship between the amounts of the various compounds and the various types of fault is generally understood, so an early diagnosis by performing a routine TOGA analysis results as a prevention of future failures.

This method covers the procedure for extraction and measurement of gases dissolved in electrical insulating oil having a viscosity of 20cSt or less at 40°C, following the ASTM D 3612-C Method.

The gases to be measured include Hydrogen (H₂), Oxygen (O₂), Nitrogen (N₂), Carbon Monoxide (CO), Carbon Dioxide (CO₂), Methane (CH₄), Ethane (C₂H₆), Ethylene (C₂H₄), Acetylene (C₂H₂), Propane (C₃H₈) and Propylene (C₃H₆).

The analytical method consists of the extraction of the dissolved gases by mean of the Headspace sampling technique.

A portion of the headspace phase in equilibrium with the oil is sampled and automatically introduced into a gas chromatographic system.



The Perfect Answer to a Severely Regulated Market

DANI Master GC Turn-Key Analyzers provide the analytical capability and power required for the most demanding methods including:

ASTM D1945 : Standard Test for Analysis of Natural Gas by Gas Chromatography

ASTM D2163 Standard Test Method for Analysis of Liquid Petroleum (LP) Gases and Propene Concentrates by Gas Chromatography

ASTM D6729, ASTM D6730, ASTM D6733: Standard test Method for Determination of Individual Components in Spark Ignition Engine Fuels by Capillary High Resolution Gas Chromatography

ASTM D5134 : Standard Test Method for Detailed Analysis of Petroleum Naphtas through n-Nonane by Capillary Gas Chromatography

ASTM D4815 : Standard Test Method for Determination of MTBE, ETBE, TAME, DIPE, tertiary-Amyl Alcohol and C1 to C4 Alcohols in Gasoline by Gas Chromatography

ASTM D6751 : Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillated Fuels

ASTM D5580 : Standard Text Method for Determination of Benzene, Toluene, Ethylbenzene, p/m-Xylene, C9 and heavier Aromatics, and Total Aromatics in Finished Gasoline by Gas Chromatography

ASTM D2421 : Standard Practice for Interconversion of Analysis of C5 and Lighter Hydrocarbons to Gas-Volume, Liquid-Volume, or Weight Basis.

ISO 6974 : Determination of composition with defined uncertainty by gas chromatography.

ISO 6975 : Natural gas -- Extended analysis -- Gaschromatographic method.

UOP 539 : Refinery Gas Analysis by Gas Chromatography.

EN 14106 : Fat and oil derivatives. Fatty acid methyl esters (FAME). Determination of free glycerol content.

EN 14110 : Determination of Methanol in Fatty Acid Methyl Esters (FAME) for use as Diesel Fuel and Domestic Heating Oil

ASTM D3612 : Standard Test Method for Analysis of Gases Dissolved in Electrical Insulating Oil by Gas Chromatography

The Ultimate Aim is to be ready for every possible challenge.

The unmatched flexibility of DANI Master GC allows tailored gas chromatographic solutions.

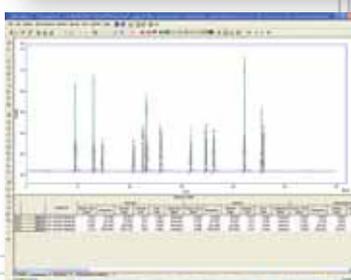
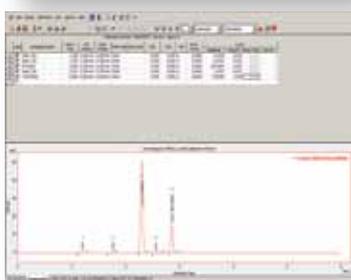
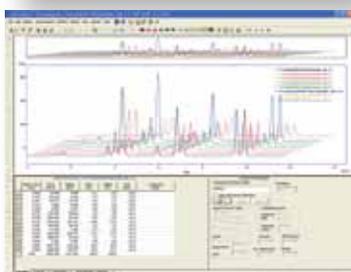
DANI Instruments already provides all the solutions to fit the standard requirements and is also available to fit them to the customer needs.

But sometimes new challenges arise and pre-defined systems are not enough. This is why DANI Instruments is ready to develop special and dedicated configuration systems according to customer's specific requirements.



The most Universal Software that fits every Laboratory Demand

The CLARITY Chromatography Station provides full control of the Master GC, Turn-Key Analyzers and sampling introduction systems offering a flawless solution to process all the data acquired in real time and reliably.



Clarity Software Features:

Integration. There is an extensive possibility to modify chromatograms. The chromatogram can be changed by entering global parameters or interactively, through direct graphic modification of the baseline.

Overlay. This function simultaneously displays a virtually unlimited number of chromatograms and their mathematical modifications. For example, mutual deductions or derivations of any order.

Calibration. There are internal and external standard calculation methods, calibration of groups of peaks method for better identification.

Automated measuring support. Sequence tables for any set of samples with or without an autosampler.

Postrun. The software automatically displays, prints, exports and starts other programs after the completion of a measurement.

Summary result tables. It's possible to display and print selected results from all simultaneously displayed chromatograms.

User Settings. User can select parameters for peak display and the specification for axes, including colour from an extensive array of colour settings. Text labels and lines, either as part of the area or anchored to a chromatogram, may also be inserted.

Customized Reports. Analysis reports can be customized and stored as report files. Reports can be saved as templates and automatically generated to improve the output of routine laboratories.

Import & Export. Clarity imports chromatograms or mathematical curves, which have been saved in text or AIA formats, from other programs. Optional exportation of all results, with or without the chromatogram, in various formats, into a file or clipboard.





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AUTHORIZED DEALER

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