CALIDUS

ultraFAST micro GAS CHROMATOGRAPH

from . . . FALCON Analytical


FASTER


SMALLER


SMARTER


EASIER


GREENER

FALCON

Fast Analytical Solutions & Technologies

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ultraFAST micro GAS CHROMATOGRAPH

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Introduces the *CALIDUS*™ microGC Faster, Smaller, Smarter, Easier and Greener than Traditional Gas Chromatographs

CALIDUS™ ***microGC with optional autosampler and laptop interface***.

FASTER – With analytical cycles 10 to 50 times faster than traditional gas chromatography, the ***CALIDUS***™ **microGC** vastly increases responsiveness for the data consumer. Less time spent waiting on results means more productivity and timely control of the measured process. In the hands of lab and process managers, the speed of the *CALIDUS* microGC can translate into better quality products, produced faster and more profitably than ever before.

SMALLER – Elimination of the air bath column ovens, required for traditional gas chromatography drastically reduces the *CALIDUS*™ micro gas chromatograph footprint. Yet, the *CALIDUS* microGC delivers all the functionality of the much larger, high thermal mass, traditional GCs. At less than 25 pounds, *CALIDUS* offers advanced analytical chemistry in a highly compact and transportable package.

The smaller size of the *CALIDUS* microGC means more efficient utilization of space and, ultimately, bigger profits for the user. The price per square foot for laboratory bench top space may only be exceeded by the cost of installation for online systems in the processing plant. The small *CALIDUS* footprint allows for higher installation density in the laboratory and in shelters for process applications. This small footprint also enables process installation schemes that place the analyzer much closer to its sampling point in the plant. Closer proximity means less sample lag time, as well as more representative measurements for process control.

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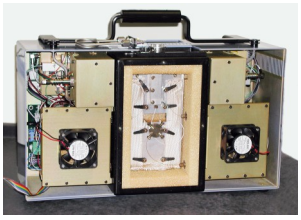
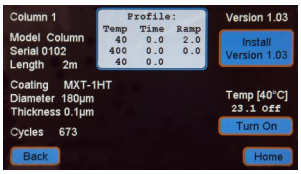
SMARTER – Using modern computing with standard operating systems and software, the automated *CALIDUS* microGC frees valuable technical resources from the daily grind of interpreting and validating chromatographic results. Built-in ***LineUp***^{TM} technology from ***Infometrix, Inc.*** virtually eliminates misidentification of components and drastically reduces the need for expensive calibration sample runs. Less time spent calibrating the analyzer means more time spent on more economically valuable diagnostics, most notably measured process deviations from the setpoint.



EASIER – Proprietary, plug and play temperature-programmed gas chromatography column modules allow the *CALIDUS* microGC to avoid the complicated and troublesome valve schemes used in isothermal process analyzers and many lab gas chromatographs. Global patents are pending for this unique micro gas chromatograph.



Correlation between laboratory systems and online process control systems becomes realistically possible with the *CALIDUS* microGC, because both physical packages use the same measurement principle, hardware and methodology. Applying the *CALIDUS* microGC in-lab and online means less time spent reconciling lab and process measurements and validating which result is correct. More time can be spent working on more valuable, direct process optimization.

GREENER – The obvious and extraordinary features and benefits of the *CALIDUS* microGC combine to yield something that may not be that evident: ***Green Process Analytical Chemistry***. *CALIDUS* is greener – whether in the control laboratory, online in the processing plant, near line in the pilot plant or when transported for field measurements. Consuming less than 300 Watts in operation, the *CALIDUS* microGC uses a small fraction of the traditional gas chromatograph consumption rate of up to 3000 Watts.

With analytical cycles that are a minimum of 10 times faster and the low electrical load needed for operation, the *CALIDUS* microGC power consumption per analysis is 1% or less of the energy required by traditional gas chromatography. Combine these savings with the reduction in workload for air conditioning systems and the *CALIDUS* solution is greener still. The *CALIDUS* product life cycle environmental impact from manufacturing throughout its useful lifetime to disposal is far less than traditional GCs.

THE RESULT – Faster, Smaller, Smarter, Easier and Greener = better quality, increased productivity, profitability and versatility, with far less hassle and environmental impact. That summarizes the successful, business application equation for the ***CALIDUS***^{TM} **microGC**.

Please review all the content in this brochure and then contact Falcon Analytical to discuss your potential applications.

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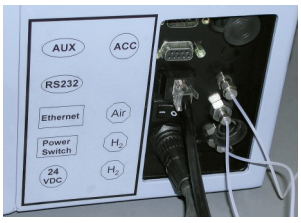
General Specifications shown here.
See specific model literature for details.

Operating Environment
Operating Temperature Range: 0°C to 35°C
Storage Temperature Range: -20°C to 60°C
Relative Humidity Range: 0 to 100% (non-condensing)

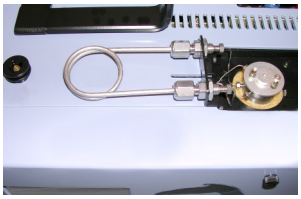


Power Requirements
Less than 300 watts peak power at startup, practical use < 200 Watts for gas or liquid analyses 24 VDC supplied from external power supply, 100 -240VAC using 50/60Hz AC.

Safety
General purpose, light industrial (lab instrument environment)
CE Mark and Nationally Recognized Testing Laboratory (NRTL) certified (TUV Rheinland) pending.

Gas Supplies
50 PSIG, 99.995% hydrogen at up to 250 ml/min, 50 PSIG Zero air for FID operation.

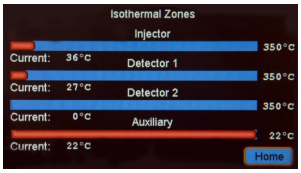
Sample Requirements (via split/splitless injector with septum purge)
Air or gaseous samples. Membrane, SPME and static and dynamic headspace extracts. Direct liquid injections neat or dilute organic solvents (DCM, Hexane, MEK, Toluene, methanol, etc.).



Dimensions
17" wide by 8.5" deep by 11" high, ~ 25 lbs. Uninterrupted power supply and data acquisition computer external to the base unit.

Controls/Outputs
All functions and parameters can be set via Ethernet or USB. Start analysis can be triggered from the instrument display panel or by method from an external computer running ChromPerfect Software™. Column signals are digitized for each column in 24-bit resolution, the FID at 100 Hz and TCD at 50 Hz. ChromPerfect also supplies a full array of control and processing options for other analyzer functions and settings.

Front Panel Displays
The front panel is an LCD touch screen supplying temperature and pressure readings, function on/off, power on/off, status of analysis columns (isothermal, programming, cool down, ready, and cycles run).



Performance (application dependent)
Repeatability of ± 1% RSD or better (area) and of ± 0.1% RSD or better (retention times). Analysis times for VOCs can be <20 seconds and for SVOCs <60 seconds. Dynamic range depends on detector used and application (FID typically 10^5).

Why Falcon?

Why did the producers of the ***CALIDUS***^{TM} **microGC** choose the name **"Falcon"** for their company and the name **"Calidus"** for their first proprietary analyzer?

The *Peregrine Falcon* (*Falco Peregrinus*) has been a symbol of speed and power for centuries. Falconry, the use of birds of prey in hunting, dates back to the year 2000 B.C. Because of its strength, intelligence and maneuverability, the Falcon was always prized among those who hunted with powerful birds.

The Peregrine Falcon can reach speeds over 200 mph (320 km/h) in a dive and flying speeds of up to 120 mph (192 km/h), making it the fastest animal on the planet. Highly versatile and adaptable, the Falcon can be found nearly everywhere on Earth.

The Falcon is compact, with a body length of 13 to 23 inches (34 to 58 centimeters). The Falcon is light, with the heaviest examples of the species weighing only about four pounds. The Falcon is reliable and devoted. It mates for life.

Why Calidus?

The Calidus Falcon (*Falco Peregrinus Calidus)* may be the heartiest and most adaptable of all the Falcons, ranging from the Arctic to Sub-Saharan Africa. While some races of Falcons have been seriously threatened by environmental challenges, the Calidus has continued to thrive in all environments. Symbolic of the portability of the analyzer bearing its name, the Calidus is fully migratory, moving from its northernmost range to its southernmost habitat with the turn of seasons.

It is easy to understand why this company chose the Falcon and the Calidus subspecies to symbolize their enterprise and their extraordinary new gas chromatographic analyzer.

CALIDUS

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The ***CALIDUS™*** **microGC** is a fast programmed temperature micro gas chromatograph consisting of . . .

Heated split/splitless injection port including septum purge and 350°C maximum operating temperatures. The inlet can accept gas or liquid syringe injections or optionally use an automated gas or liquid sample valve.

Two column modules for simultaneous detection on two individual column types.

Plug and play, precalibrated and individually programmed temperature column modules, enabling dual simultaneous analysis on the same sample, using different separation media and temperature profiles for maximum selectivity.

Flame Ionization Detection and Thermal Conductivity Detection (constant temperature filament) are available. Maximum detector operating temperature is 350°C.

ChromPerfect chromatography data system running on a Windows PC.

System configurations enabling measurement of fixed gases up through components with boiling points equivalent to n-C_{50}. Samples can be gas or liquid phase and can be directly injected into the split/splitless injection port. Optional SP/ME and other sampling methods are available.

See the technical specifications inside for more information.

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CALIDUS

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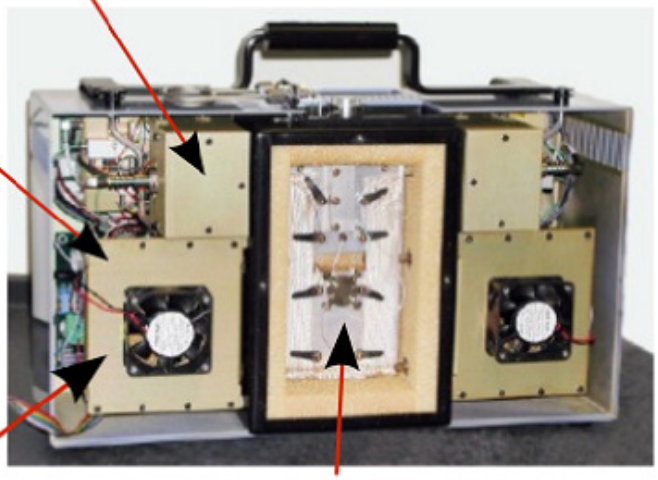
Modular

ultraFAST GC

Detector Modules
microFID 100Hz
microTCD 50Hz

portable
Lab GC
Process Control

less than 10Kg
43x22x28cm



Unique Features

Dual Column System

300watts max

100/220VAC
50/60Hz
24VDC Ext

Columns 2 metre
Restek MXT Capillary
0.28, 0.53
and new 0.18mmID
many Liquid Phases
PLOT
MolSieve 5A
Alumina
Porous Polymer; Hayesep
microPacked Columns

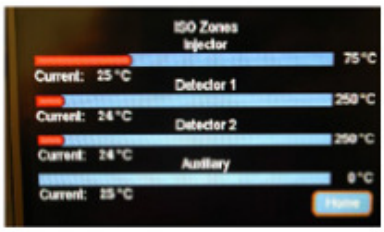
Oven Modules
- 2 direct heated
600degC per min
400degC max
from 5degC
above ambient

Sample Processing Unit
Column Switching Module

Operating System
ChromPerfect 100Hz 24bit
/ Win PC(external)

ultraFAST GC . . . 10 to 50 times faster than conventional GC from gases to C60

VOCs in 20 to 60seconds, semi-VOCs in 60-120seconds



LCD Touch Screen
for operating parameters
- temperatures
- pressures
- on/off functions
- analysis status

Cooling Fans

TCD

PTCM

FID

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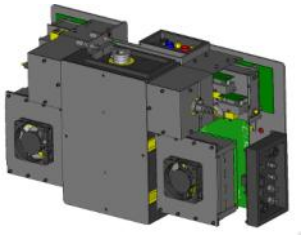
12/13
Website NEW : www.chromalytic.com.au E-Mail : info@chromtech.net.au Tel : 03 9762 2034 . . . in AUSTRALIA

CALIDUS™ the Modular micro Gas Chromatograph

- **Sample Processing Unit**
- **Plug & Play Programmed Temperature Column Modules**
- **Plug & Play Detector Modules**
  - **Flame Ionization**
  - **Thermal Conductivity**



A CALIDUS micro gas chromatograph features fully-independent Programmed Temperature Column Modules (PTCM) that can be operated isothermally and interfaced to a Sample Processing Unit (SPU). Detector Modules (DM) are also fully-independent and can be mixed and matched within the CALIDUS Sample Processing Unit environment.

- **SPU -** standard with a split/splitless injection port (1:1 up to 1:200) suitable for gas or liquid samples via a syringe through the septum injection, optional automated sampling valves for gas or liquids or an optional auto-sampler capable of liquid or heated headspace gas samples. The inlet includes septum purge to prevent bleed components from entering the system.
- **PTCM -** resistively heated steel capillary chromatography column with necessary hardware, software and electronic control for temperature programming from 0.1°C to 10°C per second from 5°C above ambient to 400°C depending on the model and maximum temperature capability of the column material selected.
- **DM -** incorporates micro Flame Ionization Detector (FID) or micro Thermal Conductivity Detector (TCD) with the necessary hardware, software and electronic control to provide detector temperature control and digital output signal.
  - **FID -** fully digital carbon/hydrogen bond detector using the hydrogen flame to burn the sample components. It uses an electrometer to sense the current changes in the flame cell due to chromatographic component elution. Control is provided for the fuel supply pressure and auto-ignition. The data rate is 100 Hz.
  - **TCD -** fully digital, universal detector consisting of a constant temperature filament sensing the change in power required to hold the filament temperature constant due to chromatographic component elution. The data rate is 50 Hz.

CALIDUS is controlled with ChromPerfect chromatography data system and fully integrated with LineUp running on a Windows PC.

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SIGNIFICANCE AND USE

The CALIDUS micro gas chromatograph provides a simple ultra-fast analysis (10-50 times faster than conventional lab or process GC's) of fixed gases and hydrocarbons up to C_{50}. CALIDUS is available for laboratory, at-line, transportable or online use in the hydrocarbon processing industry, environmental labs, pharmaceuticals, food and beverage industry, military, medical industry, and educational markets.

The analyses are used for product specifications testing, product safety, environmental testing and measurements, process control, catalyst protection, educational tools, spot checks of fuels and many more.

Faster, Smaller, Smarter, Easier, Greener

CALIDUS™ micro Gas Chromatograph

- **Model 101**
- **Model 101 HT**
- **Model 201**
- **Model 301**
- **Model CS**

5 CALIDUS Models combine various standard modules to provide general or specific applications and expanded measurement capabilities. Each of these models can be installed as a plug and play module within the Calidus process analyzer enclosure.

CALIDUS Model 101 - 3 modules, a Sample Processing Unit, a Programmed Temperature Column Module and a Detector Module interfaced with the ChromPerfect chromatography data system and fully integrated with LineUp running on a Windows PC. The user may select either a micro FID or TCD and one of the available different PTCMs to separate and measure fixed gases and hydrocarbons up to C_{44}.

CALIDUS Model 101 HT - a 101 with a PTCM using High Temperature MXT-1HT Sim Dist column and a micro FID module specifically for determination of boiling range distribution of petroleum products and biodiesel formulations up to C_{50} in boiling point. The analyzer is interfaced with the ChromPerfect chromatography data system, SimDis 2000 software, and fully integrated with LineUp running on a Windows PC. An ASTM method for Ultra Fast Micro GC 2887 is currently under development based on the CALIDUS Model 101 HT.

CALIDUS Model 201 - 4 modules, 2 PTCMs in series with one Sample Processing Unit and one Detector Module interfaced with ChromPerfect chromatography data system and fully integrated with LineUp running on a Windows PC. There are two major advantages for having two PTCMs in series. First is the ability to leverage selectivity of different stationary phases. And second, is virtually doubling the column length for even greater separation power up to C_{44}.

CALIDUS Model 301- 5 modules, a Sample Processing Unit with a single injector connected to a splitter dividing the sample between two PTCMs in parallel, each with a single micro FID or TCD Detector Module. The Model 301 handles hydrocarbon samples with a wide range of boiling points and a wide range of concentrations (% to ppm) with better separation and faster analysis all without complicated valve schemes and resultant additional hardware.

CALIDUS Model CS (Column Switching) - 5 modules, a Sample Processing Unit with a single injector connected to a 6-port diaphragm/plunger column valve, two PTCMs in parallel, and two detector Modules. This model can be plumbed to perform heartcutting from one PTCM with its own FID or TCD Detector Module to a second PTCM with its own FID or TCD Detector Module. Backflushing configurations are available too. This model is used for analysis where a specified discrete hydrocarbon (s) must be separated and measured from a defined stream or sample composition typically within a required time frame with optimum selectivity (up to C_{12}).

CALIDUS
micro GAS CHROMATOGRAPH


TCD


PTCM


FID

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CALIDUS™ 101 micro Gas Chromatograph

GC analysis for virtually any fixed gas and hydrocarbons up to C_{44} for laboratory, at-line, transportable or online use

- **Upstream (E&P)**
- **Petrochemical/Chemical**
- **Food & Beverage**
- **Military**
- **Refining**
- **Pharmaceutical**
- **Medical**
- **Educational**

CALIDUS Model 101 - comprised of 3 modules

A single Sample Processing Unit with a standard split/splitless injection port (1:1 up to 1:200) suitable for gas and liquid samples via either syringe through the septum injections, optional gas, liquid or headspace auto-sampler, or automated sampling valves. The inlet includes septum purge to prevent bleed components from entering the system.

A single Programmed Temperature Column Module containing the resistively heated steel capillary chromatography column with necessary hardware, software and electronic control to enable temperature programming from 0.1°C to 10°C per second from 5°C above ambient to 350°C depending on the maximum temperature capability of the column material selected.

A single Detector Module incorporating either a micro Flame Ionization Detector (FID) or micro Thermal Conductivity Detector (TCD) with the necessary hardware, software and electronic control to provide detector temperature control, digital output signal and additionally for proper FID fuel supply pressure and auto-ignition.

> The micro FID is a fully digital carbon/hydrogen bond detector using the hydrogen flame to burn the sample components. It uses an electrometer to sense the current changes in the flame cell due to chromatographic component elution. The data rate is 100 Hz.
>
> The micro TCD is a fully digital, universal detector. The TCD consists of a constant temperature filament that senses change in power required to hold the filament temperature constant when chromatographic components elute. The power measurement is used to determine the amount of the component eluting from the column. The data rate is 50 Hz.

CALIDUS is controlled with ChromPerfect chromatography data system fully integrated with LineUp running on a Windows PC.

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SIGNIFICANCE AND USE

The Model 101 is the simplest configuration of the CALIDUS micro GC systems. It provides ultra -fast analysis (10 to 50 times faster than conventional lab or process GC's) of fixed gases and hydrocarbons to C_{44}. It is ideal for sample scouting, methods development and transportable uses. Simplicity doesn't negate the powerful capability of this model.

The analyses are used for product specifications testing, product safety, environmental measurements, process control, catalyst protection, educational tools, spot checks of fuels and many more.

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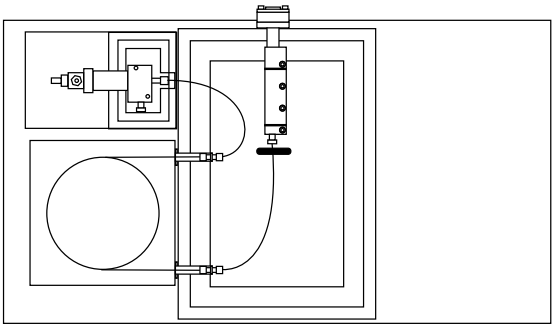
CALIDUS™ 101 Specifications (global patents pending)

December 1, 2010



Ambient Environment
Operating Temperature Range: 0°C to 35°C
Storage Temperature Range: -20°C to 60°C
Relative Humidity Range: 0 to 100% (non-condensing)

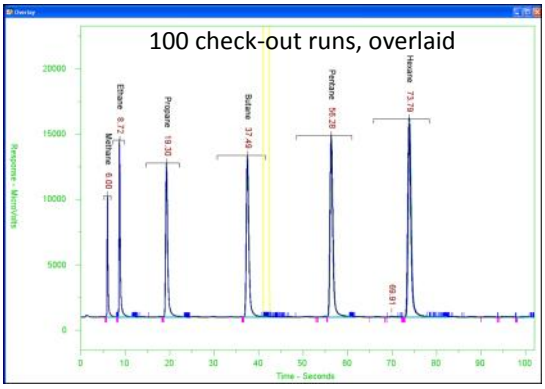
Power Requirements
Less than 300 watts peak power at startup, practical use < 200 Watts for gas or liquid analyses
24 VDC supplied from external power supply, 100-240VAC using 50/60Hz AC

Safety
General purpose, light industrial (lab instrument environment)
CE Mark and Nationally Recognized Testing Laboratory (NRTL) certified pending (TUV Rheinland)

Gas Supplies
50 PSIG, 99.995% H_2 or He at up to 250 ml/min, 50 PSIG zero air for FID operation

Sample Requirements (via split/splitless injector with septum purge)
Air or gaseous samples at 0 to 50 PSIG at ambient temperature
Membrane, SPME and static and dynamic headspace extracts
Direct liquid injections neat or dilute organic solvents (DCM, hexane, MEK, toluene, methanol, CS_2 etc.)

Dimensions
17" wide by 8.5" deep by 11" high, ~ 20 lbs
Uninterrupted power supply and data acquisition computer external to the base unit



Controls/Outputs
All functions and parameters via ethernet or RS-232 using ChromPerfect™ software
Start analysis from keyboard or GC
Set method from external computer using ChromPerfect software
50-100Hz digitization (detector dependent) on each column, 24 bit resolution, auto zero on each run
Trigger in and ready out signals plus an array of others via ChromPerfect

Front Panel Displays
Temperature and pressure readings, function on/off, other
Power on/off
Status of analysis columns (isothermal, programming, cool down, ready, cycles run, other)

Standard Equipment
One capillary column, 2m long, 100µm to 320µm ID, temperature programmable from 0.1 to 10°C per second from 5°C above ambient to 350°C (maximum temperature software limited to be no greater than the limit for the columns installed, isothermal operation is available). Column modules are 2 meter columns in Mxt-1, Mxt-5, Mxt-1701, Mxt-Wax, Mxt-MoleSieve, Mxt-Alumina, < 320µm & various film thicknesses with others coming soon.
Flame ionization or thermal conductivity (filament) detection
Gas and liquid inlet for syringe injection of samples or automated gas and liquid sample valves available

Performance (application dependent)
Repeatability of ± 1% RSD or better (area) and of ± 0.1% RSD or better (retention times)
Analysis times for VOCs: can be <20 seconds and for SVOCs: can be <60 seconds
Dynamic range: depends on detector used and application (FID typically 10^5)

Data Processing and Instrument Control
Note: computer system is integral and necessary component of the analysis system and includes the following requirements:
RS-232 or USB to RS-232 adapter, ethernet
Windows XP or newer operating environment
ChromPerfect software for dual column data acquisition via RS-232 serial or ethernet ports

Faster, Smaller, Smarter, Easier, Greener

CALIDUS^{tm} 101 HT micro Gas Chromatograph

Simulated Distillation GC analysis for virtually any hydrocarbon fuel or fuel blend component up to C_{50} for laboratory, at-line, transportable or online use.

- **Upstream (E&P)**
- **Petrochemical/Chemical**
- **Educational**
- **Refining**
- **Military**

CALIDUS Model 101 HT - comprised of 3 modules fitted with high temperature inlet and column operational components

A single Sample Processing Unit with a standard split/splitless injection port (1:1 up to 1:200) suitable for gas and liquid samples via either syringe through the septum injections, optional gas, liquid or headspace auto-sampler, or automated sampling valves. The inlet includes septum purge to prevent bleed components from entering the system. The maximum operating temperature is 350°C.

A single Programmed Temperature Column Module containing a high temperature resistively heated steel capillary chromatography column with necessary hardware, software and electronic control to enable temperature programming from 0.1°C to 5°C per second from 5°C above ambient to 400°C. The column is Mxt 1-HT for high temperature simulated distillation gas chromatography.

A single Detector Module incorporating a micro Flame Ionization Detector (FID) with the necessary hardware, software and electronic control to provide detector temperature control (350°C maximum), digital output signal and additionally for proper FID fuel supply pressure and auto-ignition.

> The micro FID is a fully digital carbon/hydrogen bond detector using the hydrogen flame to burn the sample components. It uses an electrometer to sense the current changes in the flame cell due to chromatographic component elution. The data rate is 100 Hz.

CALIDUS 101-HT is controlled with ChromPerfect chromatography data system fully integrated with LineUp and SimDist 2000 running on a Windows PC. An ASTM method for Ultra Fast Micro GC D-2887 is currently under development based on CALIDUS 101-HT.

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SIGNIFICANCE AND USE

The Model 101 HT provides a simple ultra-fast (10 to 50 times faster than conventional lab or process GC's) simulated distillation analysis for hydrocarbons to C_{50}. This system is ideally configured for liquid fuels and fuel component characterization by boiling range distribution including gasoline range organics up through gas oil and even crude oil.

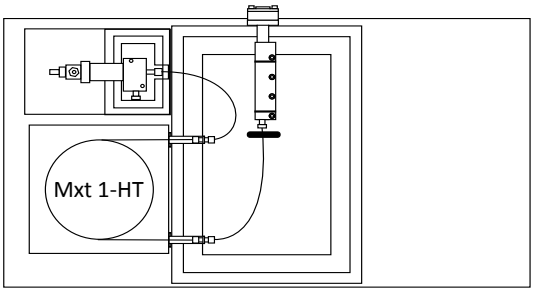
The analyses are used for exploration & production liquids characterization, fuels specification testing, regulatory evaluations, environmental measurements, process control, transportable spot check of fuels and many more.

Faster, Smaller, Smarter, Easier, Greener

CALIDUS^{tm} 101 HT Specifications (global patents pending)

December 1, 2010

Ambient Environment
Operating Temperature Range: 0°C to 35°C
Storage Temperature Range: -20°C to 60°C
Relative Humidity Range: 0 to 100% (non-condensing)

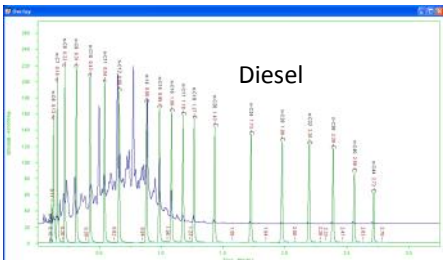


Power Requirements
Less than 300 watts peak power at startup, practical use < 200 Watts for gas or liquid analyses
24 VDC supplied from external power supply, 100-240VAC using 50/60Hz AC

Safety
General purpose, light industrial (lab instrument environment)
CE Mark and Nationally Recognized Testing Laboratory (NRTL) certified pending (TUV Rheinland)

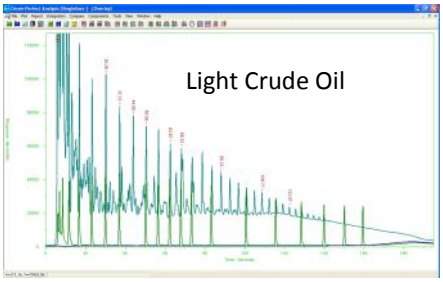
Gas Supplies
50 PSIG, 99.995% H_2 or He at up to 250 ml/min, 50 PSIG zero air for FID operation

Sample Requirements (via split/splitless injector with septum purge)
Air or gaseous samples at 0 to 50 PSIG at ambient temperature
Membrane, SPME and static and dynamic headspace extracts
Direct liquid injections neat or dilute organic solvents (DCM, hexane, MEK, toluene, methanol, CS_2 etc.)



Dimensions
17" wide by 8.5" deep by 11" high, ~ 20 lbs
Uninterrupted power supply and data acquisition computer external to the base unit

Controls/Outputs
All functions and parameters via ethernet or RS-232 using ChromPerfect™ software
Start analysis from keyboard or GC
Set method from external computer using ChromPerfect software
50-100Hz digitization (detector dependent) on each column, 24 bit resolution, auto zero on each run
Trigger in and ready out signals plus an array of others via ChromPerfect



Front Panel Displays
Temperature and pressure readings, function on/off, other
Power on/off
Status of analysis columns (isothermal, programming, cool down, ready, cycles run, other)

Standard Equipment
One capillary column, 2m long, 100µm, Mxt 1-HT, temperature programmable from 0.1 to 5°C per second from 5°C above ambient to 400°C (maximum temperature software limited to be no greater than the limit for the Mxt 1 HT column installed, isothermal operation is available).
Flame ionization detection, data rate 100 Hz
Gas and liquid inlet for syringe injection of samples or automated gas and liquid sample valves available

Performance (application dependent)
Repeatability of ± 1% RSD or better (area) and of ± 0.1% RSD or better (retention times)
Analysis times for fuel and fuel components: can be <60 seconds and up to 300 seconds
Dynamic range: depends on detector used and application (FID typically 10^5)

Data Processing and Instrument Control
Note: computer system is integral and necessary component of the analysis system and includes the following requirements:
RS-232 or USB to RS-232 adapter, ethernet
Windows XP or newer operating environment
ChromPerfect software for single column data acquisition via RS-232 serial or ethernet ports
CALIDUS 101 HT comes with LineUp peak alignment and Simdist-2000 simulated distillation software fully integrated.

CALIDUS™ 201 micro Gas Chromatograph

GC analysis for virtually any fixed gas and hydrocarbons up to C_{44} for laboratory, at-line, transportable or online use

- **Upstream (E&P)**
- **Petrochemical/Chemical**
- **Food & Beverage**
- **Military**
- **Refining**
- **Pharmaceutical**
- **Medical**
- **Educational**

CALIDUS Model 201 - comprised of 4 modules

A single Sample Processing Unit with a standard split/splitless injection port (1:1 up to 1:200) suitable gas and liquid samples via either syringe through the septum injections, optional gas, liquid or headspace auto-sampler, or automated sampling valves. The inlet includes septum purge to prevent bleed components from entering the system.

Two Programmed Temperature Column Modules (PTCM) in series containing the resistively heated steel capillary chromatography column with necessary hardware, software and electronic control to enable temperature programming from 0.1°C to 5°C per second from 5°C above ambient to 350°C depending on the maximum temperature capability of the column material selected. Each column module is independently controlled by the method and can be any of the available column types.

A single Detector Module incorporating either a micro Flame Ionization Detector (FID) or micro Thermal Conductivity Detector (TCD) with the necessary hardware, software and electronic control to provide detector temperature control, digital output signal and additionally for proper FID fuel supply pressure and auto-ignition.

> The micro FID is a fully digital carbon/hydrogen bond detector using the hydrogen flame to burn the sample components. It uses an electrometer to sense the current changes in the flame cell due to chromatographic component elution. The data rate is 100 Hz.
>
> The micro TCD is a fully digital, universal detector. The TCD consists of a constant temperature filament that senses change in power required to hold the filament temperature constant when chromatographic components elute. The power measurement is used to determine the amount of the component eluting from the column. The data rate is 50 Hz.

CALIDUS is controlled with ChromPerfect chromatography data system fully integrated with LineUp running on a Windows PC.

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SIGNIFICANCE AND USE

The Model 201 provides a simple ultra-fast analysis (10 to 50 times faster than conventional lab or process GC's) of fixed gases and hydrocarbons to C_{44}. Use of two different PTCMs in series, for example one polar and one non-polar column material enables leveraging the selectivity differences for enhanced separations. Secondly, using two identical PTCMs virtually doubles the column length.

The analyses are used for product specifications testing, product safety, environmental measurements, process control, catalyst protection, educational tools, spot checks of fuels and many more.

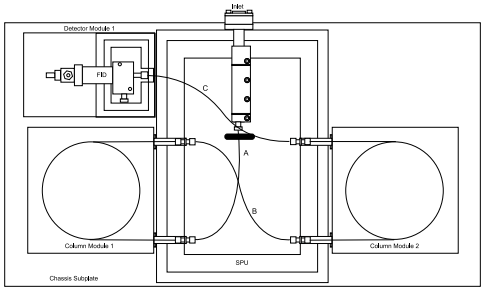
Faster, Smaller, Smarter, Easier, Greener

CALIDUS™ 201 Specifications (global patents pending)

December 1, 2010

Ambient Environment
Operating Temperature Range: 0°C to 35°C
Storage Temperature Range: -20°C to 60°C
Relative Humidity Range: 0 to 100% (non-condensing)

Power Requirements
Less than 300 watts peak power at startup, practical use < 200 Watts for gas or liquid analyses
24 VDC supplied from external power supply, 100-240VAC using 50/60Hz AC



Safety
General purpose, light industrial (lab instrument environment)
CE Mark and Nationally Recognized Testing Laboratory (NRTL) certified pending (TUV Rheinland)

Gas Supplies
50 PSIG, 99.995% H_2 or He at up to 250 ml/min, 50 PSIG zero air for FID operation

Sample Requirements (via split/splitless injector with septum purge)
Air or gaseous samples at 0 to 50 PSIG at ambient temperature
Membrane, SPME and static and dynamic headspace extracts
Direct liquid injections neat or dilute organic solvents (DCM, hexane, MEK, toluene, methanol, CS_2 etc.)

Dimensions
17" wide by 8.5" deep by 11" high, ~ 20 lbs
Uninterrupted power supply and data acquisition computer external to the base unit

Controls/Outputs
All functions and parameters via ethernet or RS-232 using ChromPerfect™ software
Start analysis from keyboard or GC
Set method from external computer using ChromPerfect software
50-100Hz digitization (detector dependent) on each column, 24 bit resolution, auto zero on each run
Trigger in and ready out signals plus an array of others via ChromPerfect

Front Panel Displays
Temperature and pressure readings, function on/off, other
Power on/off
Status of analysis columns (isothermal, programming, cool down, ready, cycles run, other)

Standard Equipment
Two capillary columns, 2m long, 100µm to 320µm ID, temperature programmable from 0.1 to 5°C per second from 5°C above ambient to 350°C (maximum temperature software limited to be no greater than the limit for the columns installed, isothermal operation is available). Column modules are 2 meter columns in Mxt-1, Mxt-5, Mxt-1701, Mxt-Wax, Mxt-MoleSieve, Mxt-Alumina, < 320µm and various film thicknesses with others coming soon.
Flame ionization or thermal conductivity (filament) detection
Gas and liquid inlet for syringe injection of samples or automated gas and liquid sample valves available

Performance (application dependent)
Repeatability of ± 1% RSD or better (area) and of ± 0.1% RSD or better (retention times)
Analysis times for VOCs: can be <20 seconds and for SVOCs: can be <60 seconds
Dynamic range: depends on detector used and application (FID typically 10^5)

Data Processing and Instrument Control
Note: computer system is integral and necessary component of the analysis system and includes the following requirements:
RS-232 or USB to RS-232 adapter, ethernet
Windows XP or newer operating environment
ChromPerfect software for dual column data acquisition via RS-232 serial or ethernet ports

CALIDUS™ 301 micro Gas Chromatograph

GC analysis for virtually any fixed gas and hydrocarbons up to C_{44} for laboratory, at-line, transportable or online use

- **Upstream (E&P)**
- **Petrochemical/Chemical**
- **Food & Beverage**
- **Military**
- **Refining**
- **Pharmaceutical**
- **Medical**
- **Educational**

CALIDUS Model 301 - comprised of 5 modules

A single Sample Processing Unit with a standard split/splitless injection port (1:1 up to 1:200) suitable gas and liquid samples via either syringe through the septum injections, optional gas, liquid or headspace auto-sampler, or automated sampling valves. The inlet includes septum purge to prevent bleed components from entering the system. The sample is then delivered to a sample splitter for analysis on two independent column modules.

Two Programmed Temperature Column Modules (PTCM) in parallel containing the resistively heated steel capillary chromatography column with necessary hardware, software and electronic control to enable temperature programming from 0.1°C to 5°C per second from 5° C above ambient to 350°C depending on the maximum temperature capability of the column material selected. Each column module is independently controlled by the method and can be any of the available column types.

Two independent Detector Modules incorporating either a micro Flame Ionization Detector (FID) or micro Thermal Conductivity Detector (TCD) with the necessary hardware, software and electronic control to provide detector temperature control, digital output signal and additionally for proper FID fuel supply pressure and auto-ignition.

> The micro FID is a fully digital carbon/hydrogen bond detector using the hydrogen flame to burn the sample components. It uses an electrometer to sense the current changes in the flame cell due to chromatographic component elution. The data rate is 100 Hz.
>
> The micro TCD is a fully digital, universal detector. The TCD consists of a constant temperature filament that senses change in power required to hold the filament temperature constant when chromatographic components elute. The power measurement is used to determine the amount of the component eluting from the column. The data rate is 50 Hz.

CALIDUS is controlled with ChromPerfect chromatography data system fully integrated with LineUp running on a Windows PC.

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SIGNIFICANCE AND USE

The Model 301 provides a simple ultra-fast analysis (10 to 50 times faster than conventional lab or process GC's) of fixed gases and hydrocarbons to C_{44}. Use of two different PTCMs in parallel with their own detectors for example one TCD and one FID with the appropriate column material enables leveraging the sensitivity and selectivity differences for enhanced separations. Proper choice of columns enables wide boiling range and concentration ranges with a single GC.

The analyses are used for product specifications testing, product safety, environmental measurements, process control, catalyst protection, educational tools, spot checks of fuels and many more.

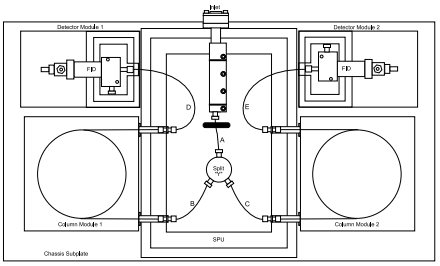
Faster, Smaller, Smarter, Easier, Greener

CALIDUS™ 301 Specifications (global patents pending)

December 1, 2010

Ambient Environment
Operating Temperature Range: 0°C to 35°C
Storage Temperature Range: -20°C to 60°C
Relative Humidity Range: 0 to 100% (non-condensing)

Power Requirements
Less than 300 watts peak power at startup, practical use < 200 Watts for gas or liquid analyses
24 VDC supplied from external power supply, 100-240VAC using 50/60Hz AC



Safety
General purpose, light industrial (lab instrument environment)
CE Mark and Nationally Recognized Testing Laboratory (NRTL) certified pending (TUV Rheinland)

Gas Supplies
50 PSIG, 99.995% H_2 or He at up to 250 ml/min, 50 PSIG zero air for FID operation

Sample Requirements (via split/splitless injector with septum purge)
Air or gaseous samples at 0 to 50 PSIG at ambient temperature
Membrane, SPME and static and dynamic headspace extracts
Direct liquid injections neat or dilute organic solvents (DCM, hexane, MEK, toluene, methanol, CS_2 etc.)

Dimensions
17" wide by 8.5" deep by 11" high, ~ 20 lbs
Uninterrupted power supply and data acquisition computer external to the base unit

Controls/Outputs
All functions and parameters via ethernet or RS-232 using ChromPerfect™ software
Start analysis from keyboard or GC
Set method from external computer using ChromPerfect software
50-100Hz digitization (detector dependent) on each column, 24 bit resolution, auto zero on each run
Trigger in and ready out signals plus an array of others via ChromPerfect

Front Panel Displays
Temperature and pressure readings, function on/off, other
Power on/off
Status of analysis columns (isothermal, programming, cool down, ready, cycles run, other)

Standard Equipment
Two capillary columns, 2m long, 100µm to 320µm ID, temperature programmable from 0.1 to 5°C per second from 5° above ambient to 350°C (maximum temperature software limited to be no greater than the limit for the columns installed, isothermal operation is available). Column modules are 2 meter columns in Mxt-1, Mxt-5, Mxt-1701, Mxt-Wax, Mxt-MoleSieve, Mxt-Alumina, < 320µm and various film thicknesses with others coming soon.
Flame ionization or thermal conductivity (filament) detection
Gas and liquid inlet for syringe injection of samples or automated gas and liquid sample valves available

Performance (application dependent)
Repeatability of ± 1% RSD or better (area) and of ± 0.1% RSD or better (retention times)
Analysis times for VOCs: can be <20 seconds and for SVOCs: can be <60 seconds
Dynamic range: depends on detector used and application (FID typically 10^5)

Data Processing and Instrument Control
Note: computer system is integral and necessary component of the analysis system and includes the following:
RS-232 or USB to RS-232 adapter, ethernet
Windows XP or newer operating environment
ChromPerfect software for dual column data acquisition via RS-232 serial or ethernet ports

CALIDUS™ CS micro Gas Chromatograph

GC analysis for virtually any fixed gas and hydrocarbons up to C_{12} for laboratory, at-line, transportable or online use

- **Upstream (E&P)**
- **Petrochemical/Chemical**
- **Food & Beverage**
- **Military**
- **Refining**
- **Pharmaceutical**
- **Medical**
- **Educational**

CALIDUS Model CS - comprised of 5 modules

A single Sample Processing Unit with a standard split/splitless injection port (1:1 up to 1:200) suitable gas and liquid samples via either syringe through the septum injections, optional gas, liquid or headspace auto-sampler, or automated sampling valves. The inlet includes septum purge to prevent bleed components from entering the system. The sample is then delivered to a column switching valve for analysis on two independent column modules.

Two Programmed Temperature Column Modules (PTCM) separated by a column switching valve containing the resistively heated steel capillary chromatography column with necessary hardware, software and electronic control to enable temperature programming from 0.1°C to 5°C per second from 5°C above ambient to 180°C (the maximum temperature for the valve, higher available on request) depending on the maximum temperature capability of the column material selected. Each column module is independently controlled by the method and can be any of the available column types.

Two independent Detector Modules incorporating either a micro Flame Ionization Detector (FID) or micro Thermal Conductivity Detector (TCD) with the necessary hardware, software and electronic control to provide detector temperature control, digital output signal and additionally for proper FID fuel supply pressure and auto-ignition.

> The micro FID is a fully digital carbon/hydrogen bond detector using the hydrogen flame to burn the sample components. It uses an electrometer to sense the current changes in the flame cell due to chromatographic component elution. The data rate is 100 Hz.
>
> The micro TCD is a fully digital, universal detector. The TCD consists of a constant temperature filament that senses change in power required to hold the filament temperature constant when chromatographic components elute. The power measurement is used to determine the amount of the component eluting from the column. The data rate is 50 Hz.

CALIDUS is controlled with ChromPerfect chromatography data system fully integrated with LineUp running on a Windows PC.

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SIGNIFICANCE AND USE

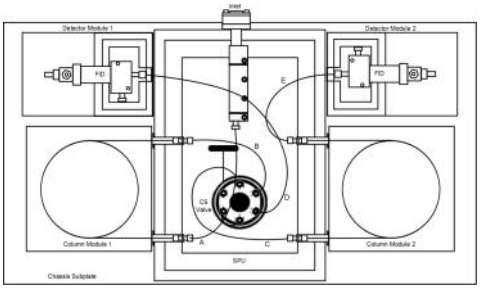
The Model CS provides a simple ultra-fast analysis (10 to 50 times faster than conventional lab or process GC's) of fixed gases and hydrocarbons to C_{12}. Use of two different PTCMs with their own detectors separated by the column switching valve with the appropriate column material enables leveraging the sensitivity and selectivity differences for enhanced separations (for example heartcuts and backflushing). Proper choice of columns enables wide boiling range and concentration ranges with a single GC. Model CS is ideal for individual component speciation from other sample matrix components.

The analyses are used for product specifications testing, product safety, environmental measurements, process control, catalyst protection, educational tools, spot checks of fuels and many more.

Faster, Smaller, Smarter, Easier, Greener

CALIDUS™ CS Specifications (global patents pending)

December 1, 2010



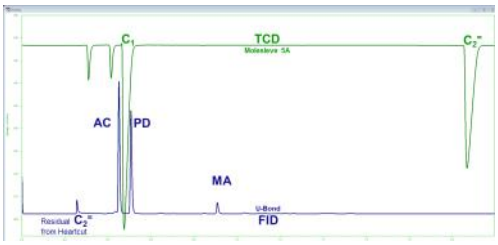
Ambient Environment
Operating Temperature Range: 0°C to 35°C
Storage Temperature Range: -20°C to 60°C
Relative Humidity Range: 0 to 100% (non-condensing)

Power Requirements
Less than 300 watts peak power at startup, practical use < 200 Watts for gas or liquid analyses
24 VDC supplied from external power supply, 100-240VAC using 50/60Hz AC

Safety
General purpose, light industrial (lab instrument environment)
CE Mark and Nationally Recognized Testing Laboratory (NRTL) certified pending (TUV Rheinland)

Gas Supplies
50 PSIG, 99.995% H_2 or He at up to 250 ml/min, 50 PSIG zero air for FID operation

Sample Requirements (via split/splitless injector with septum purge)
Air or gaseous samples at 0 to 50 PSIG at ambient temperature
Membrane, SPME and static and dynamic headspace extracts
Direct liquid injections neat or dilute organic solvents (DCM, hexane, MEK, toluene, methanol, CS_2 etc.)



Dimensions
17" wide by 8.5" deep by 11" high, ~ 20 lbs
Uninterrupted power supply and data acquisition computer external to the base unit

Controls/Outputs
All functions and parameters via ethernet or RS-232 using ChromPerfect™ software
Start analysis from keyboard or GC
Set method from external computer using ChromPerfect software
50-100Hz digitization (detector dependent) on each column, 24 bit resolution, auto zero on each run
Trigger in and ready out signals plus an array of others via ChromPerfect

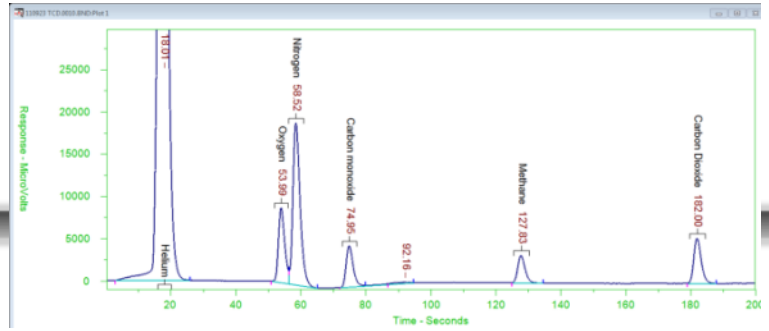
Front Panel Displays
Temperature and pressure readings, function on/off, other
Power on/off
Status of analysis columns (isothermal, programming, cool down, ready, cycles run, other)

Standard Equipment
Two capillary columns, 2m long, 100µm to 320µm ID, temperature programmable from 0.1 to 5°C per second from 5° above ambient to 350°C (maximum temperature software limited to be no greater than the limit for the columns installed, isothermal operation is available). Column modules are 2 meter columns in Mxt-1, Mxt-5, Mxt-1701, Mxt-Wax, Mxt-MoleSieve, Mxt-Alumina, < 320µm and various film thicknesses with others coming soon. The column switching valve can be plumbed in several ways but always between the two column modules.
Flame ionization or thermal conductivity (filament) detection
Gas and liquid inlet for syringe injection of samples or automated gas and liquid sample valves available

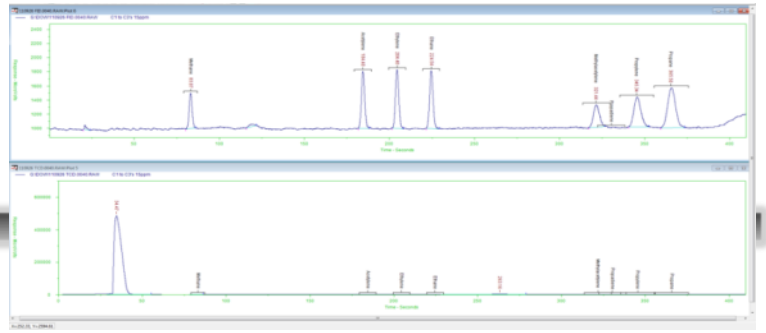
Performance (application dependent)
Repeatability of ± 1% RSD or better (area) and of ± 0.1% RSD or better (retention times)
Analysis times for VOCs: can be <20 seconds and for SVOCs: can be <60 seconds
Dynamic range: depends on detector used and application (FID typically 10^5)

Data Processing and Instrument Control
Note: computer system is integral and necessary component of the analysis system and includes the following:
RS-232 or USB to RS-232 adapter, ethernet
Windows XP or newer operating environment
ChromPerfect software for dual column data acquisition via RS-232 serial or ethernet ports

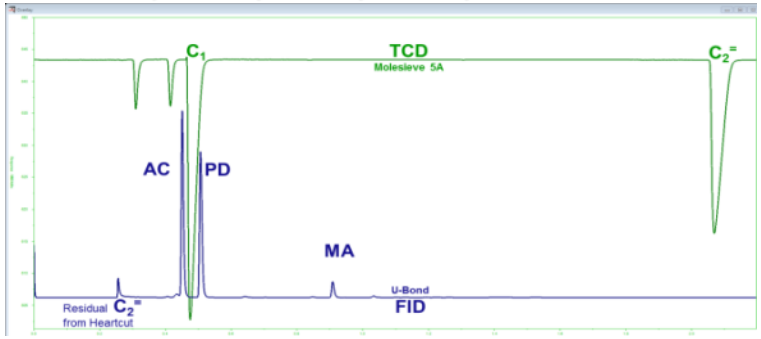
Application Range Examples



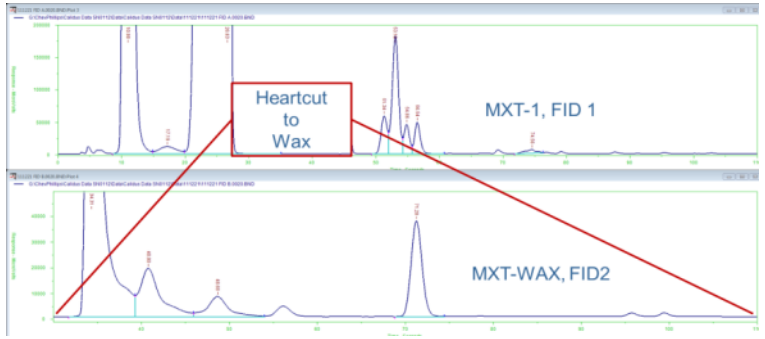
- He, O2, N2, CO, C1 CO2



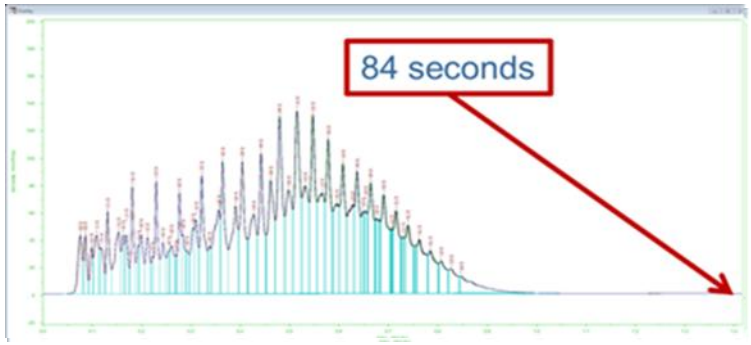
- C1, AC, C2=,C2, MA, C3=,C3



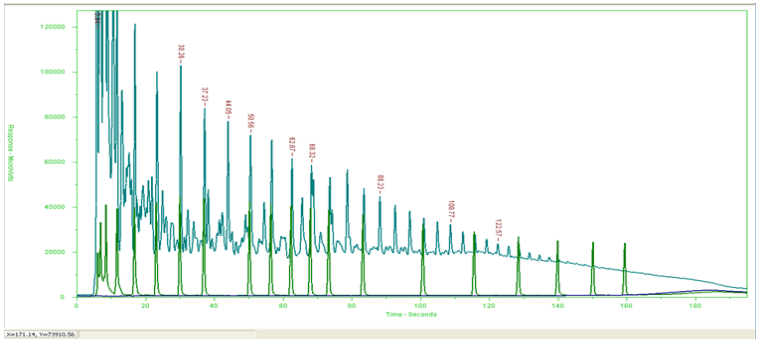
- Air, CO, C1 , C2=,AC, PD, MA



- C6, to C9 Heartcut



- ASTM D-2887 & UltraFast D-2887



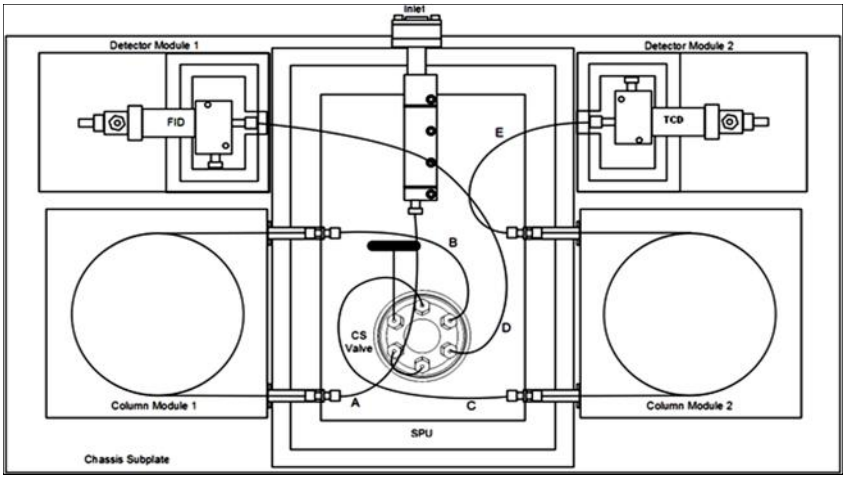
- Crude Characterizations

Application Note:

CALIDUS™ CS microGC Extended Natural Gas Application ~ July 2012

GC analysis for extended Natural Gas, i.e. fixed gases and $C_1 – C_{12}$ hydrocarbons for laboratory, at-line, transportable, or on-line, in less than six minutes.

Figure 1: CALIDUS Model CS Functional Diagram.



Application Overview (Reference Figure 1)

The Sample Processing Module with a standard split/splitless injection port and a heated gas sample valve deliver the sample to a column switching valve for analysis on two independent Programmed Temperature Column Modules (PTCM). The inlet includes septum purge to prevent bleed components from entering the system.

The two PTCMs are independently controlled by the method. PTCM 1 contains a MXT Q-Bond resistively heated stainless steel capillary column and is operated in a temperature programmed mode. This column provides separation of CO_2 and $C_1 – C_{12}$.

(**See Figures 2A & 2B**)

Figure2A: PTCM 1 MXT Q Bond Separation of CO_2 & $C_1 – C_{12}$.

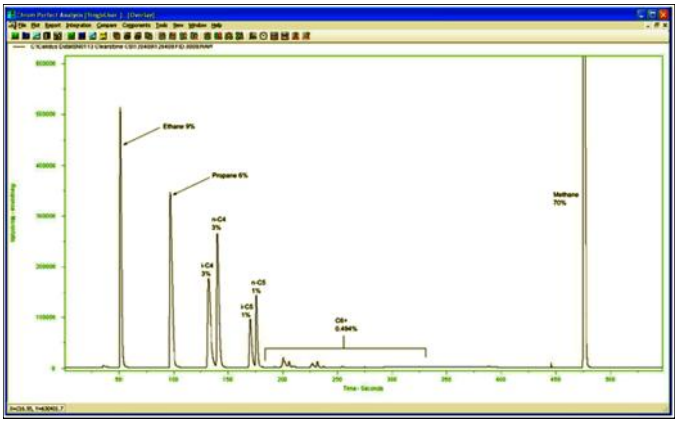
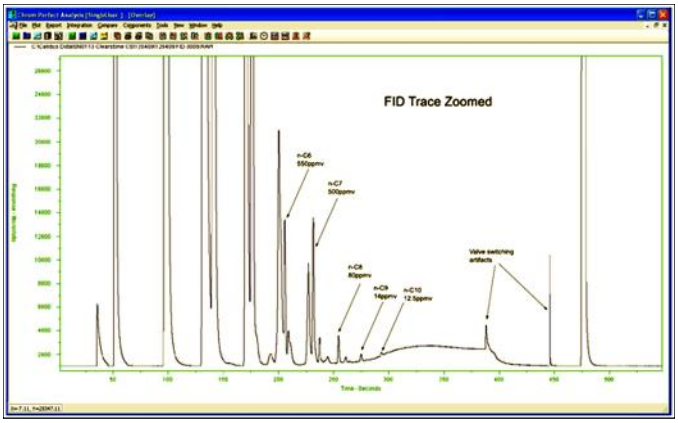


Figure 2B: PTCM 1 MXT Q Bond Separation of CO_2 & $C_1 – C_{12}$.

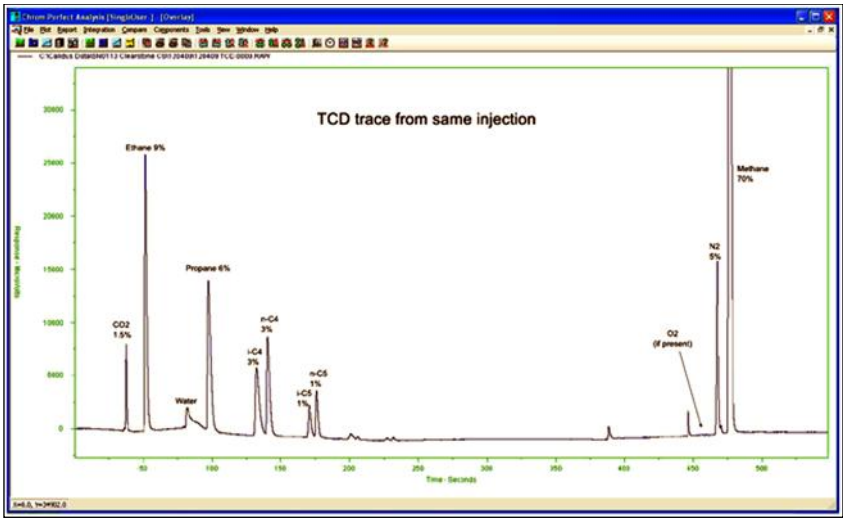


PTCM 2 contains a MXT mole sieve 5A resistively heated stainless steel capillary column and is operated in an isothermal mode. This column provides separation of CO, O_2, N_2, and C_1.

The analyzer includes ChromPerfect software for calculating and reporting BTU content as well as other physical properties such as specific gravity and compressibility.

(See Figure 3)

Figure 3: PTCM 2 MXT Mole Sieve 5A Separation of CO, O_2, N_2 & C_1.



Major Analytical Advantages

Fastest analysis time in the industry for Extended Natural Gas, with excellent performance and reliability.

Incorporates patent pending Resistively Heated Stainless Steel Capillary Column Module and its thermal management system, resulting in a paradigm shift in GC analysis.

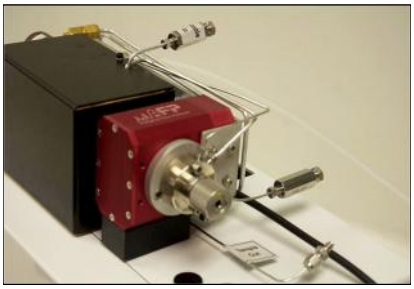
Simplest hardware analytical approach for achieving Extended Natural Gas Analysis.

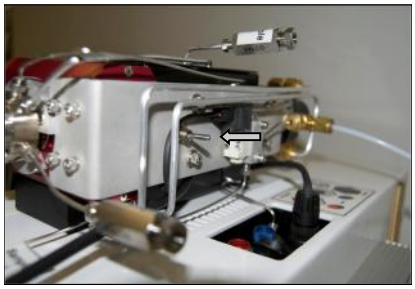
One of the most durable, compact and transportable analytical solutions for Extended Natural Gas Analysis (43 cm L X 21.5 cm D X 27.9 cm W, wt. 9.07 kg).

Expanded Application Capability for Minimal Cost

Expand capability to include LP Gas by selecting a CALIDUS CS with a simple compact Heated Gas/Liquid Sample Combo Valve. When measuring LP gas, just flip the Sample Selector Switch located on the side of the combo valve to Liquid. The valve adds less than 10% to cost while doubling the analyzer's capability to two applications.

(See Photos Below)



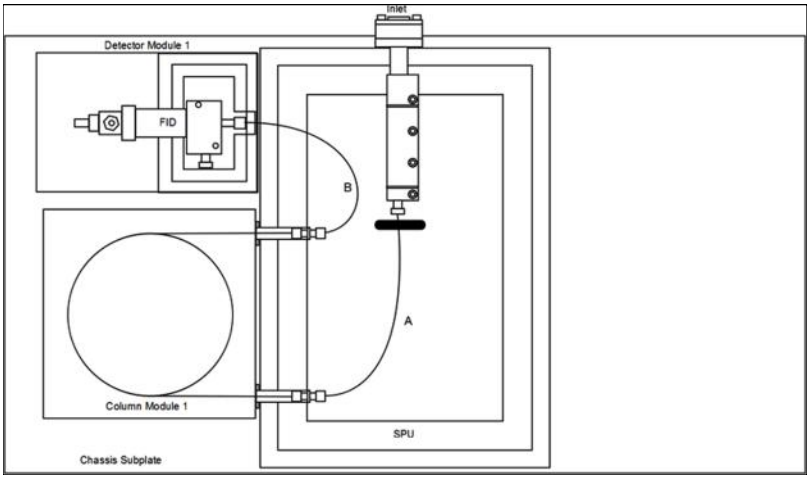


Application Note:

CALIDUS™ 101 HT microGC Ultra Fast ASTM D2887 SimDist Application November 2012

SimDist GC analysis for liquid fuels and fuel component characterization by boiling range distribution including gasoline range organics up through gas oil and even crude oil, i.e. analysis for hydrocarbons to C_{50} – in less than five minutes.

Figure 1: CALIDUS Model 101 – HT Functional Diagram .



Application Overview **(Reference Figure 1)**

The Sample Processing Module with a standard split/splitless injection port, incorporating either a syringe through septum injection, Auto Sampler, or automated liquid sample valve delivers the sample to a Programmed Temperature Column Module (PTCM). The inlet includes septum purge to prevent bleed components from entering the system.

The PTCM is controlled by the method. It contains a MXT-1 High Temperature Resistively Heated Stainless Steel Capillary Column and is operated in a temperature programmed mode. The column provides the separation of the hydrocarbons in the liquid fuel sample.

(See Figures 2 & 3)

Figure 2: Chromatogram of the Reference Gas Oil Obtained with Ultrafast Chromatograph.

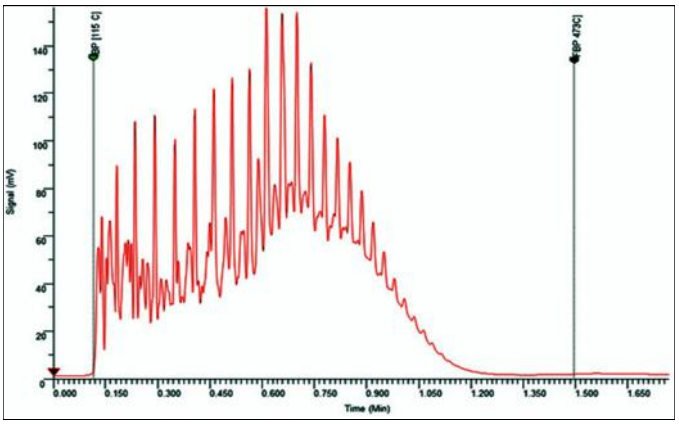


Figure 3: Blank, RT Standard & Gas Oil Overlaid. Run Time 84 Seconds.

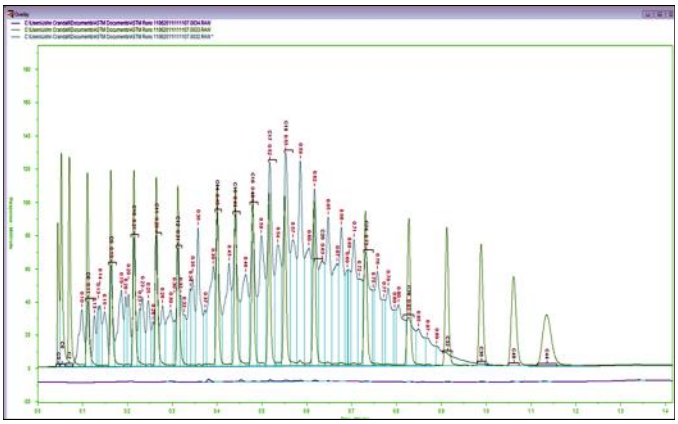
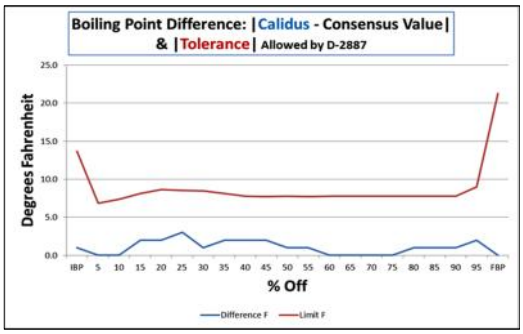


Figure 5: Absolute Values of Difference from the Consensus Values (Red is the D-2887 Tolerance)



Major Analytical Advantages

Fastest analysis time in the industry for ASTM D2887 with excellent performance and reliability.

Incorporates patent pending Resistively Heated Stainless Steel Capillary Column Module and its thermal management system, resulting in a paradigm shift in GC analysis.

One of the most durable, compact and transportable analytical solutions for Ultra Fast D2887 method (43 cm L X 21.5 cm D X 27.9 cm W, wt. 9.07 kg).

Pending ASTM Ultra Fast D2887 Method.

Area normalization and Line-Up account for sample syringe volume and any retention time variance, providing more repeatable data results.

The analyzer includes ChromPerfect chromatography data system, fully integrated, with Line-Up and SimDist 2000 running on a Windows PC for liquid hydrocarbon characterization by boiling range and reports defined by the pending ASTM Ultra Fast D2887 method.

(See Figures 4, 5 & 6)

Figure 4: SimDis 2000 2887 Report Chromatogram w/ BP Curve & Blank Chromatogram Overlaid. Selected BP Data Shown in Table.

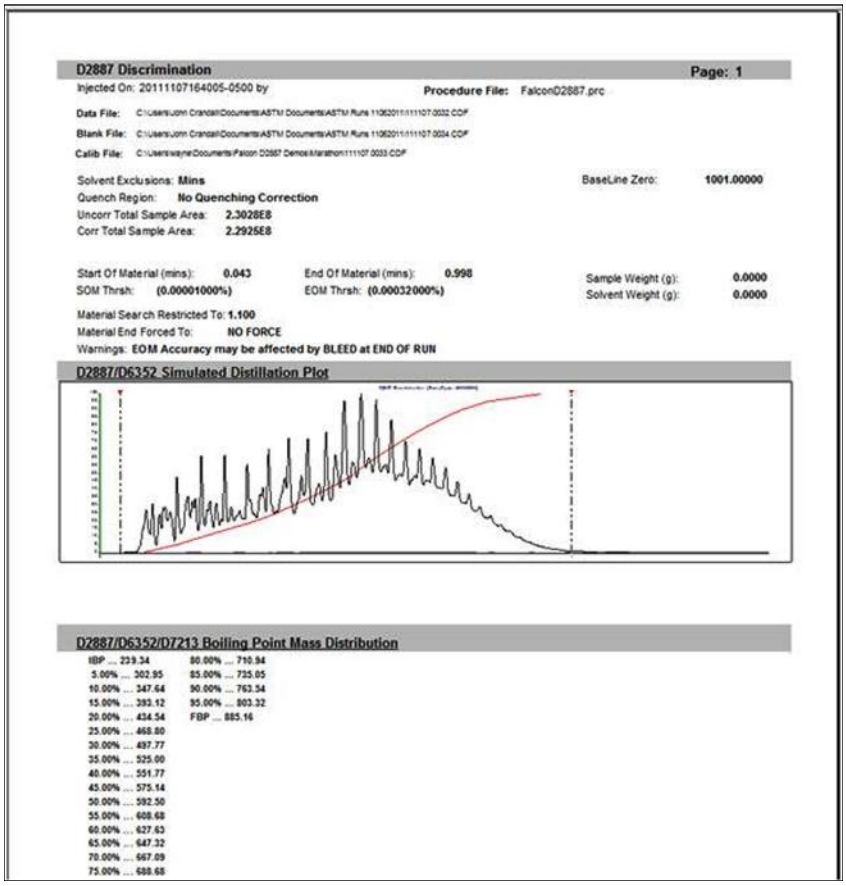


Figure 6: Chrom Perfect Setpoint Files Define GC Operations. Method Files Define System Controls.