CDS 6000 Series Pyroprobe

Thermal GC Injection Systems for Pyrolysis, Thermal Desorption, Dynamic Headspace, Evolved Gas and Weather Degradation

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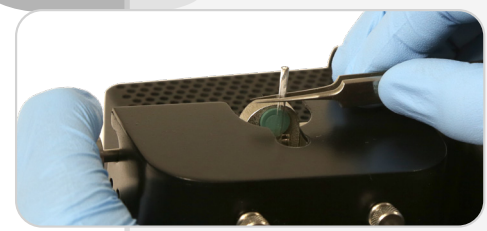
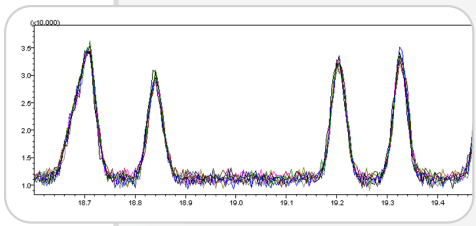
Introduction

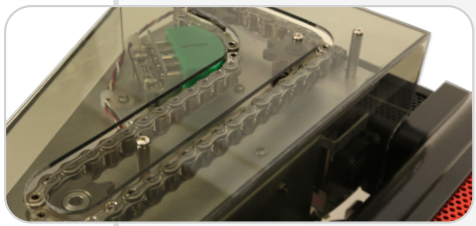
CDS Analytical is celebrating its 50th anniversary. CDS Analytical was founded by Dr. Eugene Levy in Nottingham, PA in 1969, and moved to its state-of-the-art Oxford, PA facility in 1981. Over the past 50 years, CDS Analytical has been expanding its core business from Analytical Pyrolysis to a full range of GC Sample Introduction methods, including Thermal Desorption, Purge & Trap, and Dynamic Headspace.

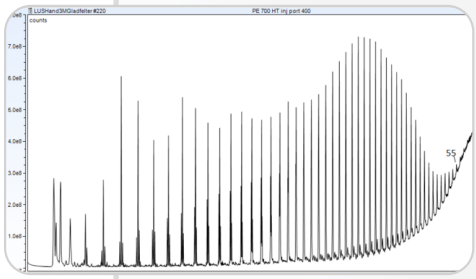
As of today, CDS Analytical gathers world-class engineers and analytical chemists working together to continue the "Made in USA" legend. We provide the best tool to our customers in Analytical Chemistry by packaging our continuous innovations in hardware, software, technology and applications into a complete solution.

The 6000 Series Pyroprobe is the 6th generation pyrolyzer proudly designed and manufactured by CDS Analytical. It is a revolutionary product with many unparalleled features to add value to your GC/MS system.









Easy Sample Loading

The 6000 Series Pyroprobe is equipped with a novel Drop-In-Sample Chamber (DISC) as a standard configuration. When coupled with the DISC sample tube, the sample preparation process no longer requires quartz wool and the sample loading is as easy as dropping a straw into a drink.

Unparalleled Reproducibility

Reproducibility with a thermal technique depends greatly on temperature accuracy. Each DISC module is factory-calibrated through a NIST traceable temperature probe at the sample position within ± 0.1 °C that brings crucial improvements over previous generations. This translates to 1.5% RSD of monomer to trimer ratio for 5 run pyrolysis Polystyrene at 500°C.

Hybrid-Driven Autosampler

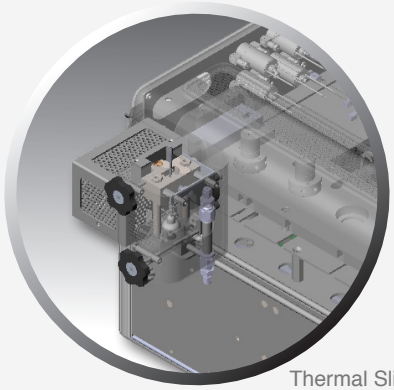
The redesigned conveyor-fed autosampler module focuses on one thing : reliability. The novel hybrid driven system adopts gravity, the most reliable force in the world, to dispense and eject the DISC sample tube.

Superior Resolution

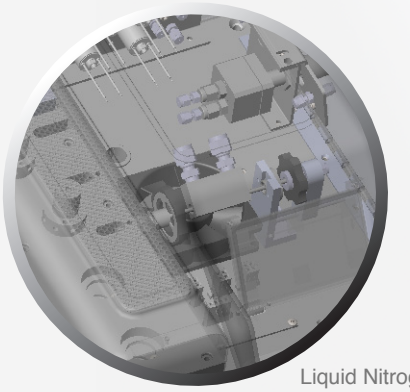
The 6000 Series Pyroprobe adopts computer-aided design, especially the Finite Element Analysis in the sample pathway development. The result is maximized instrument resolution. As a comparison, for pyrolyzing Polyethylene at 600 °C through GC with a single quad mass-spec as the detector, the 6000 Series Pyroprobe could reach C55 where our competition would stop typically at C43.

State-of-the-Art in Thermal Injection Systems

CDS pyrolyzers use a reliable and repeatable Platinum filament heating system. The proprietary energy storage system unleashes a high density electric energy to the low thermal mass filament with an astonishing 20 °C/ms coil ramp up rate. This makes the sample reach the pyrolysis temperature nearly order-of-magnitude times faster than a furnace heating pyrolyzer. In each DISC, the sample temperature is calibrated with multi-point NIST-traceable temperature probe with temperature accuracy at ± 0.1°C. The electronic system is capable of performing self-diagnosis, including a crucial leak-check function.



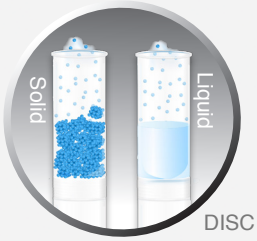
Thermal Slicing



Liquid Nitrogen Cooled Cryotrap

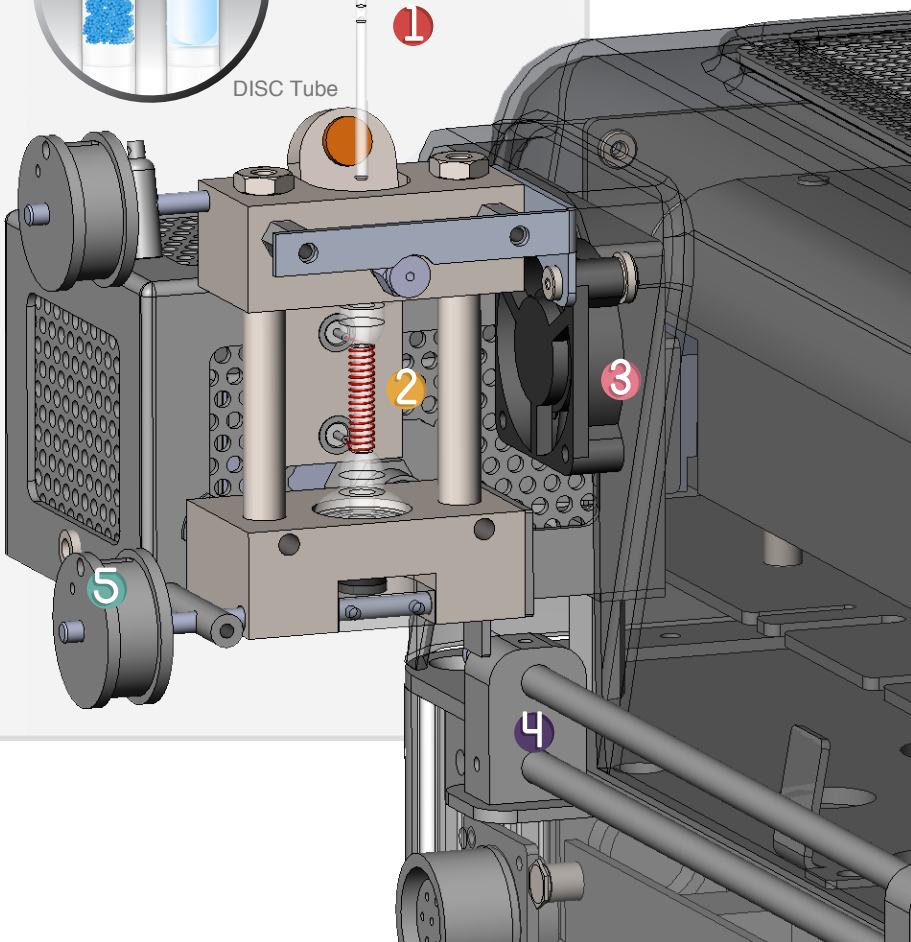
1/4" TD and 25 mL Test Tube Desorber Module

Tandem Reactor Module



DISC Tube

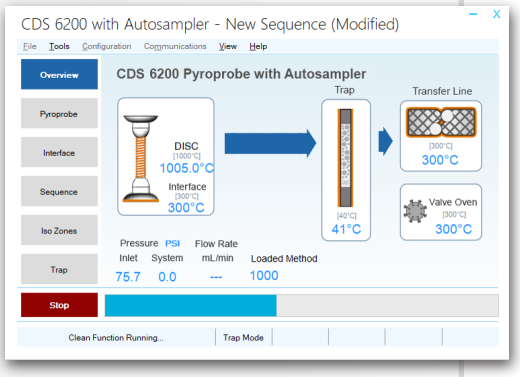
Drop in Your Sample Here



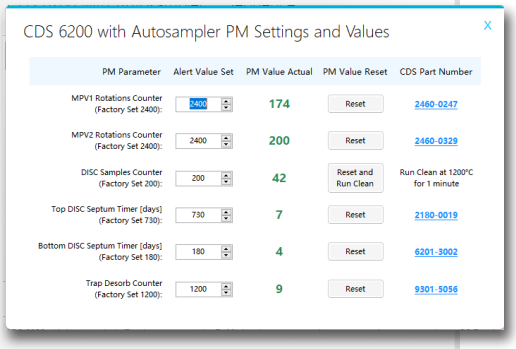
1. DISC Tube for both Solid and Liquid Sample (No quartz wool required)
2. Precision Bore Platinum Coil Calibrated with Sample Temperature Accuracy at ± 0.1°C
3. Programmable Cooling Fan for VVOC Studies
4. Multi-Function Accessory Rack for Various Modules
5. Hybrid-Driven Mechanism to Dispense and Eject Sample

The CDS 6150 Pyroprobe

Our base model instrument for pyrolyzing in PY-GC mode only. The 6150 connects to any model GC by means of a heated transfer line for easy on/off installation. The instrument supports Multi-ramp and Multi-step capability to program up to 30 temperature profiles for one sample.



Windows 11 Compatible Digital Control Interface (DCI)



Automated Preventive Maintenance Reminder

Typical Applications:

- Evolved Gas Analysis (EGA) of Polymer with Additives
- Thermal Desorption of Phthalates
- Programmable Pyrolysis of Polymer with Additives

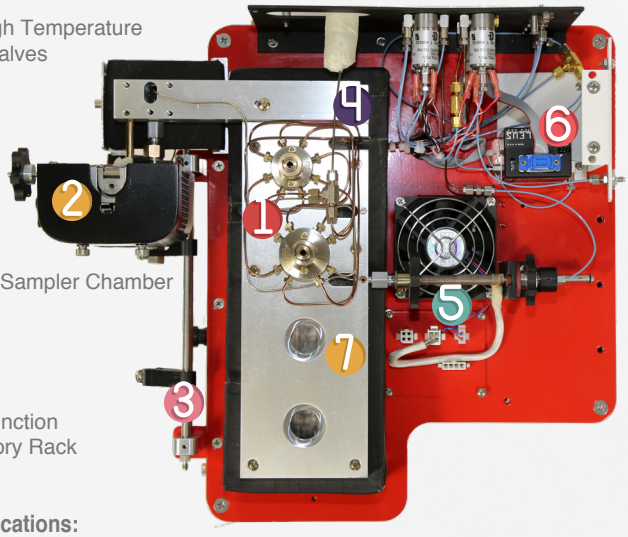
Technical Comparison:

	CDS 6150	Frontier 3030S
Max Temperature	1300°C	850 °C
Programmable Temperature	Yes, Up to 30 Steps	No
Multi-Ramp and Multi-Step	Standard	Not Supported
Temperature Accuracy	±0.1°C	±0.1°C
RSD% (Polystyrene)	1.5%	2.0%
Leak Check	Yes	No
GC Mount	Transfer Line	Direct GC Mount
Sample Tube	Quartz	Various

The CDS Pyroprobe 6200

Compared to the 6150, the 6200 Pyroprobe has a built-in focus trap which enables the instrument to collect analytes using reactant gas (like oxygen and air). Also, thermal desorption of standard ¼" x 3.5" sorbent tubes and dynamic headspace on larger volume samples (to enhance sensitivity) can be performed by adding optional modules.

1. Two High Temperature Valco Valves
2. Drop-in Sampler Chamber (DISC)
3. Multi-Function Accessory Rack



4. Silconert™ 2000 Coated Sample Pathway with Zero Cold Spot
5. Analytical Focus Trap
6. Optional Mass Flow Control
7. Expandability for Additional Modules

Typical Applications:

- Programmable Pyrolysis of Polymer with Additives
- Evolved Gas Analysis (EGA) of Polymer with Additives
- Thermal Desorption of Phthalates
- Reactive Pyrolysis in Air/O_2
- Tandem Pyrolysis through External Reactor
- Thermal Desorption for EPA TO-17
- Dynamic Headsapce for VOC and SVOC

Technical Comparison:

	CDS 6200	Frontier 3030D
Max Temperature	1300°C	1050 °C
Programmable Temperature	30 Steps	4 Steps
Temperature Accuracy	±0.1°C	±0.1°C
RSD% (Polystyrene)	1.5%	2.0%
GC Mount	Transfer Line	Direct GC Mount
Leak Check	Yes	No
Focus Trap	Standard	Optional
CryoTrap	Optional (-198°C)	Optional (-196°C)
Cooling Gas	Not Required	Required
Reactant Gas	Standard	Optional
Thermal Desorption Tube Adapter	Available	Not Available
Dynamic Headspace Adapter	Available	Not Available

The CDS 6000 Series Autosampler Module

The 6000 Series Autosampler module provides extremely reliable automated pyrolysis. Solids, viscous liquids, and powder samples are pyrolyzed in the Drop-In-Sample-Chamber (DISC) with a dependable automated sample loading mechanism (48 slots) fulfilled by this module. The autosampler module further opens up the programmable temperature capability from 30 temperature-step per sample to infinite temperature-step per sample. This autosampler module is compatible with both 6150 and 6200 Pyroprobe and adopts Dynamic Sequence Table function to allow user to add in emergency samples without interrupting scheduled samples.

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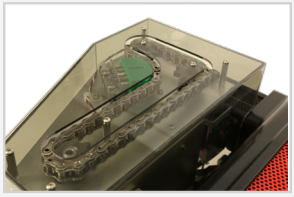
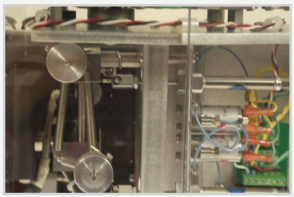


Heavy Duty 48 Position Conveyor

2

High Precision Step Motor

3



Hybrid Driven Mechanism

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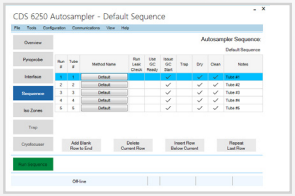


Dynamic Sequence Table

Technical Comparison:

	CDS 6000 Autosampler	Frontier 3030D/AS-1020E
Sample Positions	48	48
Programmable Temperature	Infinite Steps	8 Steps
Max Temperature	1300 °C	1050 °C
Temperature Accuracy	±0.1°C	±0.1°C
RSD% (Polystyrene)	1.5%	2.0%
Leak Check	Yes	No
Dynamic Sequence Table	Yes	No
Mount	On the Side of Pyrolyzer	On Pyrolyzer
Sample Loading/Unloading	Gravity	Gravity In and Gas Out

Polymer Library

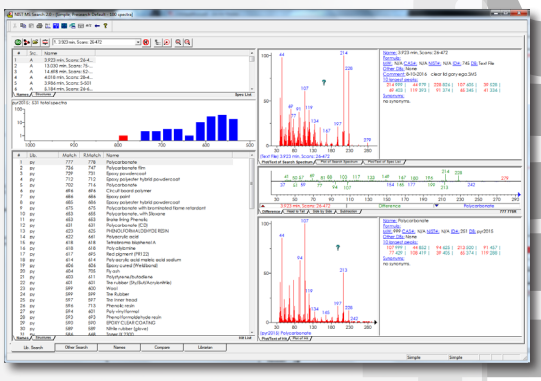
Since the analytical process of pyrolysis is to break down a polymer to volatile fragments, the MS can only identity the fragments, and not the original polymer. To help address this need, CDS has developed an effective means of searching unknown pyrograms with your existing MS to identify the polymer used in the sample matrix.

The CDS polymer library is built on 580 individually averaged spectra of industry standard polymers. When you run a sample through your GC/MS, you simply average the complete TIC spectra and then compare it to the CDS Polymer Library. Similar to results obtained from a NIST library, you will have a list of possible matches from the CDS library.

Combining averaged mass spectra with a pyrogram TIC creates a powerful two-prong method of polymeric material analysis. The technique allows analysis of individual pyrogram peaks using standard searching libraries while offering the polymer's chromatographic pattern characteristics. It also allows users to apply existing computer searching techniques to the polymer as a whole.

And, you have the ability to add your own standards to the library. This is accomplished by running your standard, averaging the TIC spectra and then entering it as a file into the CDS library.

Current compounds in the library include most of the common industrial polymers in use today, co-polymers, finished products and even biopolymers.



Photoprobe: 1 Minute of Irradiation = 2 Months of Sunlight

One of the mechanisms of polymer degradation is Photo-oxidative degradation. This is caused by photons from the sun's ultraviolet radiation that provide enough energy to cleave bonds in polymer chains, creating free radicals which react with the oxygen in the atmosphere to form degradation products. A traditional photo-oxidative degradation study takes from hours to days to complete due to limited light intensity. CDS's Photoprobe uses free-space focusing technology and improves the light intensity to 800mW/mm2 within the 260-400nm irradiation wavelength, which reduces the time on weather-induced degradation studies down to minutes.

The Sun's irradiation in an averaged 12-hour sunlight day is 2.88 kWh/day and the ultra violet (UV) range (200-400 nm) accounts for 8.7% of this energy. As a comparison, the Photoprobe generates 13.3 kWh/min in the 200-400 nm UV irradiation. Therefore, 1 minute of Photoprobe irradiation is theoretically equivalent to two-month time of direct sunshine. A 1 min of Photoprobe Exposure Time at 50% is recommended to simulate one month of outdoor exposure under direct Sunlight on the equator (80% sun day).

Thermal Desorption Pyrolysis Purge and Trap

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