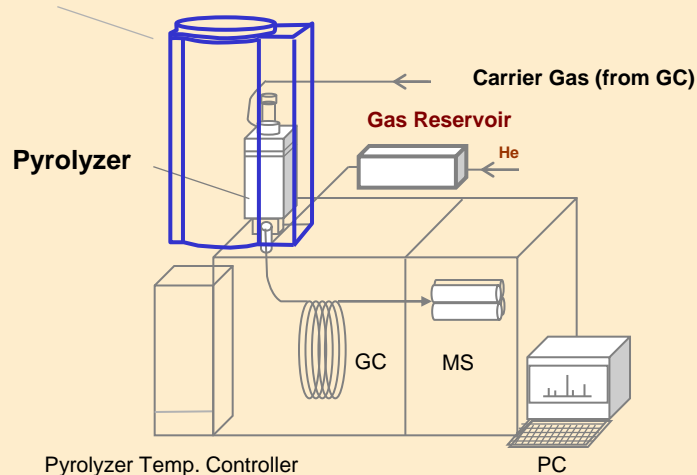


Powerful Tool for Continuous Polymer Analysis with Great Cost Savings and High Reliability  
*Designed for the Multi-functional Pyrolyzers*  
(Single-Shot / Double-Shot / EGA / Heart Cut EGA-GC modes)

# Auto-Shot Sampler AS-1020E



## Auto-Shot Sampler



*Typical Configuration of a GC/MS and Multi-Shot Pyrolyzer  
EGA/PY-3030 equipped with Auto-Shot Sampler AS-1020E*

# Features of Auto-Shot Sampler: AS-1020E

( Flash Pyrolysis/ Double-Shot Pyrolysis/ EGA/ EGA Heart-Cut GC modes)

Pyrolysis Gas Chromatography (Py-GC) is a very useful characterization tool for most of polymeric materials including insoluble solids and composite materials. Py-GC is extensively used in a wide spectrum of application areas such as polymer chemistry, quality control, forensic science, environmental research, energy related technologies, geological science, and food chemistry.

Auto-Shot Sampler: AS-1020E has been developed to allow multiple samples to analyze in such technical areas. This equipment provides significant cost savings by reducing the workload and great improvement in the reliability of analysis results when combined with the Multi-Shot Pyrolyzer EGA/PY-3030D of Frontier Laboratories Ltd.

## Advantages of Automated Analysis

### 1. Great Cost Savings by Reduction of Workload

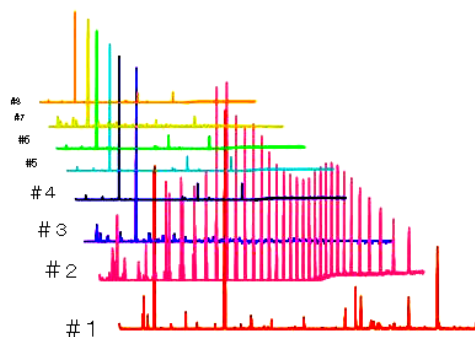
- Continuous Operation for up to 48 samples

Assuming the average time to obtain a pyrogram is one hour, analysis of 48 samples will require whole one week. The same results can be obtained in two days if the Auto-Shot sampler is used. Further, the operator can work on other tasks simultaneously.

- Sample can be analyzed by any of the four analytical methods

### 2. High Reliability of Analytical Results

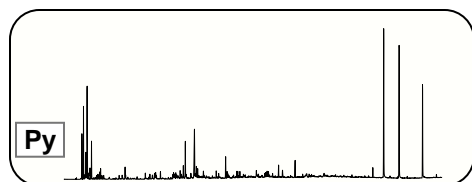
- Eliminates variations owing to operators.
- Minimizes variations due to unexpected factors such as sampling errors.



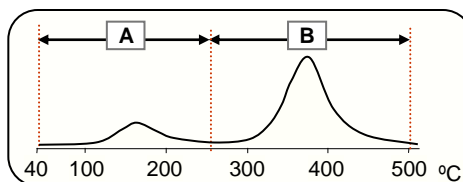
## Four Analytical methods Flash Pyrolysis/ Double-Shot Pyrolysis/ EGA/ EGA Heart-Cut GC

( Figures below show analytical results of a synthetic rubber obtained using four analytical methods )

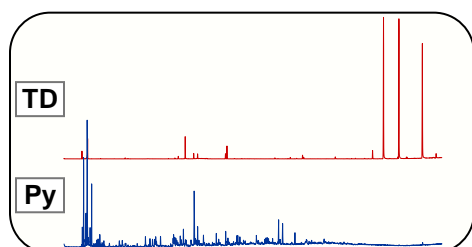
1) Flash pyrolysis-GC (Py-GC) analysis  
<Flash pyrolysis and GC analysis>



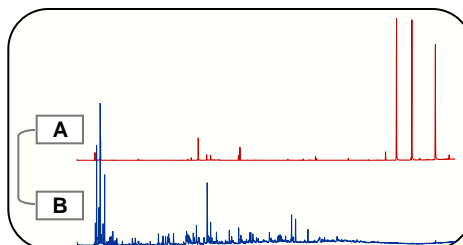
3) EGA analysis  
< Simple but powerful thermal analysis using Multi-Shot pyrolyzer>



2) Double-Shot GC Analysis  
<Thermal desorption analysis for volatiles followed by Py-GC analysis>



4) EGA Heart-Cut GC analysis  
< GC analysis of selected zones of EGA thermogram>



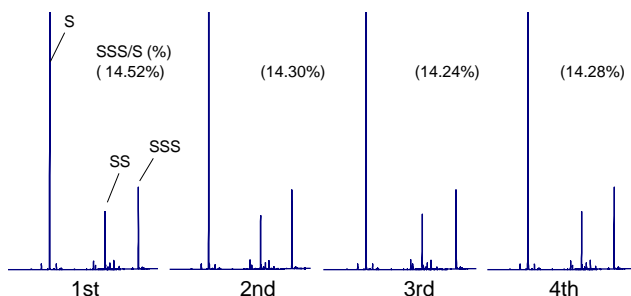
# Guarantee High Data Reproducibility and Reliability

## Combination with "Multi-Shot Pyrolyzer®" Guarantees an Excellent Reproducibility

The Multi-Shot Pyrolyzer™ with a vertical furnace employs free-fall sample introduction and guarantees reproducibility of the analytical results. An example of pyrogram reproducibility when Auto-Shot Sampler was in use is shown in the figure below. The 48 samples of about 30 µg each of polystyrene were continuously analyzed. The average peak area ratio of styrene trimer versus styrene monomer thus obtained was 14.29%, and its reproducibility expressed by relative standard deviation (C. V. %) was 1.6%.

### Reproducibility in Repeated Polystyrene Pyrolysis

Sample: Polystyrene, 30 µg, Pyrolysis at 530°C, Column Ultra ALLOY-5, 30m x 0.25mm id, 0.25µm GC Temperature 70- 320°C (20°C/min.), Detector: FID, S, SS, SSS: Styrene monomer, dimer and trimer

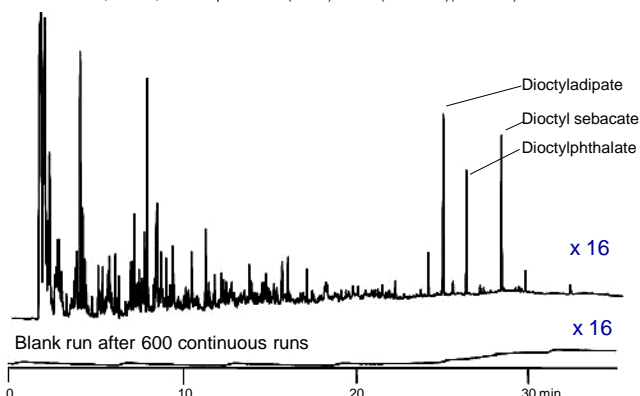


## Evaluation of the Flow Path Contamination

In a continuous operation with multiple samples, high boiling point pyrolyzates may gradually deposit and disturb the analysis. In order to test the degree of such contamination, acrylonitrile-butadiene rubber (NBR) containing a few percents of high boiling point plasticizers was subjected to 600 times continuous pyrolysis at 600°C. The charts below are the first pyrogram and the blank run (16 times magnification) after 600 pyrolysis runs. The plasticizers were not detected in the latter pyrogram even when the sensitivity of the FID was set at the highest.

### Test for Flow Path Contamination

Sample: NBR (0.5mg), Pyrolysis at 600°C, Column Ultra ALLOY-5, 30m x 0.25mm id, 0.25µm, GC Temperature 40(3 min.)- 300°C (3min. hold)(10°C/min.)



## From Sample Introduction to Sample Cup Retrieval

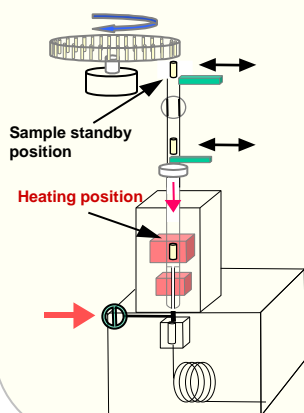
### Sample cup introduction to the pyrolyzer :

The sample cup is automatically introduced by gravity into the pyrolysis furnace through valves operating sequentially at each analysis cycle, and then heated according to the intended operation, such as thermal desorption, flash pyrolysis, or programmed temperature ramp. When heating is done stepwise, such as in the case of Double-Shot method or EGA-Heart-cut method, the sample cup travels up and down from the waiting position (ambient temperature) to the center of the heating furnace as the method specifies.

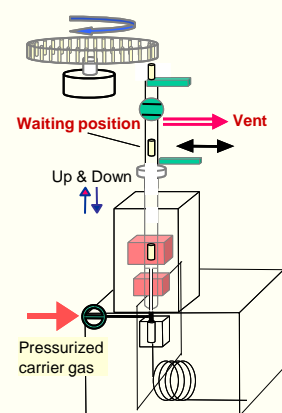
### Sample cup retrieval after analysis :

After the pyrolysis, the sample cup is blown up by the pressurized carrier gas introduced into the point between pyrolyzer and GC injection port. The cup is then retrieved into the receiver.

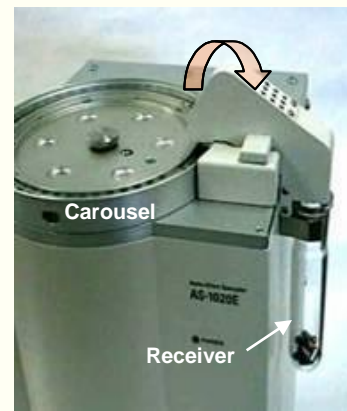
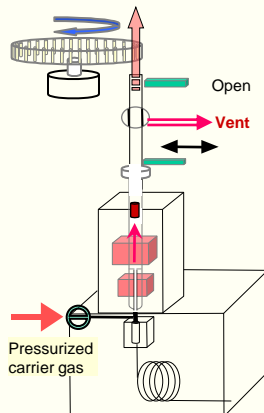
#### 1. Sample introduction by free-fall



#### 2. Sample cup movement by pressurized carrier gas and free-fall from waiting position into pyrolysis furnace.



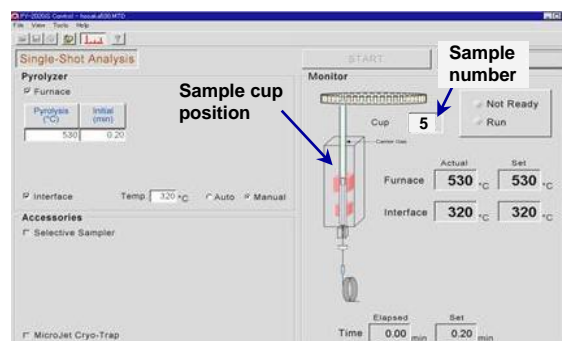
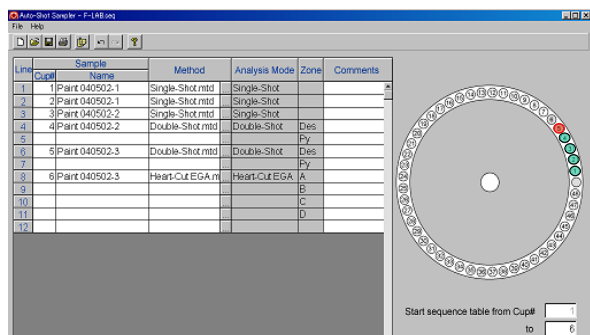
#### 3. Sample cup retrieval by pressurized carrier gas



Sample cup retrieval

# Comfortable Operation by PC control

## Screen shots of Sequence Table and Auto-Shot Sampler control



A maximum of 48 sample cups can be set at one time. They may be analyzed either in sequence or at random. Setting up of the analytical conditions is done by entering sample name, method of analysis, and mode of analysis (Single-Shot, etc.). The current status of analysis can be readily seen on the left. The samples already analyzed are in green, and the sample under analysis is in red.

The operation of Auto-Shot Sampler is done through the dedicated software that is installed on your PC which can also be used for controlling the GC. The left of the screen shows the parameters needed for operations of pyrolyzer and displaying the analysis conditions. When the analysis starts, the current sample number, the position of the cup, and flow of the carrier gas are displayed real time.

### Specifications

- Pyrolyzer: EGA/PY-3030D, PY-3030S, PY-2020iD/iS (Frontier Laboratories Ltd.)
- Sample cup retrieving method: Shooting by pressurized carrier gas
- Number of sample cups: Max 48
- Sample cup: Deactivated stainless steel cup  
( o.d. 4 mm, height 8 mm, thickness 0.1 mm, volume 80 µL volume; max. amount ~50 mg )
- Analytical mode: Single-Shot GC, Double-Shot GC, EGA and EGA Heart-cut GC analysis
- Control: Dedicated software to be installed on PC which is used for GC and GC/MS control.  
( Requires an RS232C port for Auto-Shot sampler. Pyrolyzer also requires one USB port. )
- Compatible GC (GC/MS): Agilent 7890, 6890, Shimadzu GC-2010 and GC17 series, Thermo Fisher Trace GC
- Dimension: 310 mm (H), 160 mm (W), 187 mm (D)
- Weight: 5.3kg
- Power Supply: 100/110 VAC, 50/60Hz, 60W max (Transformer for 220/240 VAC optional)

\*For product improvement, appearance and specifications are subject to change without notice.

Auto-Shot Sampler  
AS-1020E



Multi-Shot Pyrolyzer  
EGA/PY-3030D



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