MICROWAVE EXTRACTION SYSTEM

THE NEW MILESTONE

ETHOS EX Microwave Extraction System

MILESTONE

ETHOS EX

Invest in better data.

Modern analytical instrumentation such as HPLC, GC, and GC-MS is capable of extremely precise measurement. To get the most out of that equipment, it is important to remember that sample preparation can have an equally significant effect on data quality.

Milestone's **Ethos EX** is the gold standard in the field of sample extraction. It offers superior process control and reproducibility, superior flexibility for different applications, superior safety and durability, and a superior user experience.

Advantages of this technology include:

- Short extraction times. Up to 98% time savings!
- Higher analyte recoveries than older methods.
- No solvent fumes. Improved laboratory working conditions.
- Sample stirring for maximum analyte recovery.
- Precise temperature control for batch reproducibility.
- Lower solvent usage reduces solvent purchase & disposal costs.
- Unattended operation.
- Methods are easily reproducible and fully documented.
- Simple transfer from traditional techniques to microwave.

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Reaction Sensors
Temperature continuously monitored and controlled in all vessels. Solvent sensor in microwave cavity for added safety.

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User Interface
The ETHOS EX is operated via a color touch-screen terminal with Milestone's powerful EasyCONTROL software.

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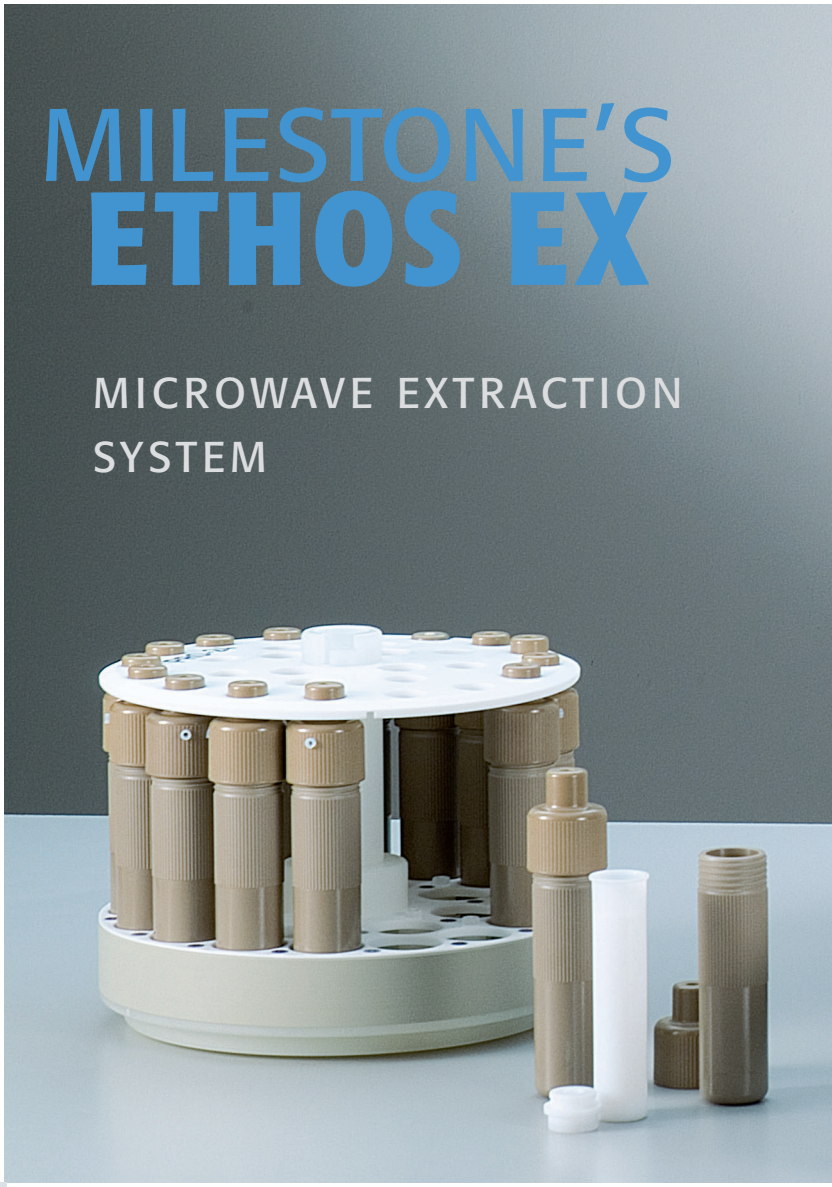
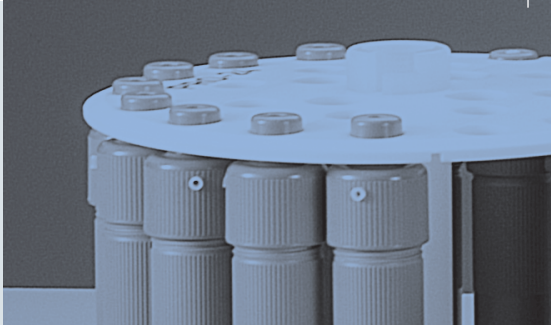
Vessel Technology
The ETHOS EX offers a wide selection of rotors with the flexibility to handle any desired application.
Vessels available from 6 mL to 270 mL.





Higher microwave power for faster vessel heating

The ETHOS EX is equipped with an industrial magnetron that delivers up to 1,200 watts of power, for rapid heating even of high-throughput rotors.

All stainless-steel construction

The chassis of the ETHOS EX is made of corrosion-resistant stainless steel, not molded plastic. The cavity and the door are plasma-coated with PTFE to protect the unit. Milestone's warranty covers the cavity coating against corrosion for 5 years!

Homogeneous microwave distribution

A microwave diffuser evenly distributes the microwave field throughout the cavity, preventing localized hot and cold spots.

Convenient, user-centric design

The ETHOS EX door includes a shock resistant double-glass window, for easy viewing of the pressure vessels. The door opens downward and can be used as a working platform to facilitate the loading of vessels into the microwave cavity.

Fast air cooling of vessels for higher throughput

The ETHOS EX is equipped with a heavy duty air flow system, placed above the microwave cavity. The air flow rapidly cools the external surfaces of the vessels. A solvent-resistant flexible hose connects the exhaust fan to a fume hood, ensuring a safe working environment.

Throughput and Reproducibility

The Ethos EX is designed to help you make the best use of your time, while delivering high-quality results. Rapid parallel processing, with minimal need for operator involvement, helps your lab to keep up with a large number of samples. Meanwhile, advanced process control features ensure that every sample is processed thoroughly–and under the same repeatable conditions.

* (US Patent 5,270,010)

ETHOS EX

Simultaneous, unattended sample processing

Process batches of samples in parallel with minimal operator involvement. High throughput minimizes the tendency for sample preparation to become the bottleneck in a busy analytical lab.

Thorough sample mixing

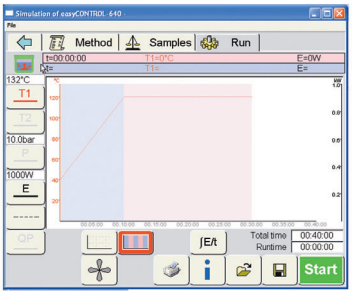
Continuous stirring at elevated temperatures keeps the sample in contact with fresh solvent, maximizing yield.

Integrated temperature control

An in-vessel temperature probe provides the most precise temperature monitoring and control. Sample preparation conditions are repeatable from batch to batch.

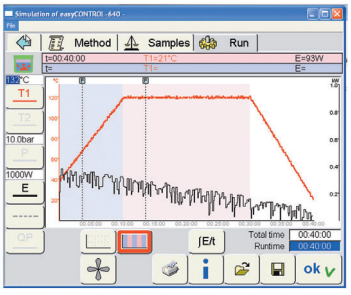
Long-term cost effectiveness

Low maintenance needs and minimal consumables mean the Ethos EX has a low cost of ownership over the long term.



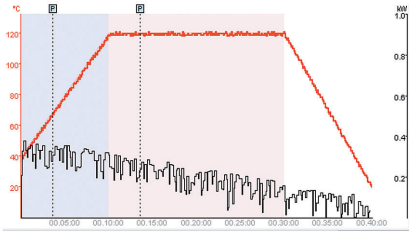
1. Define

Draw a time vs. temperature profile, or select a stored method.



2. Run

Press Start. Procedure begins, reproducing specified profile.



3. Review

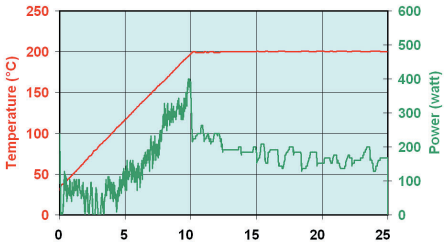
Real-time parameters display. Procedure completed.

State-of-the-Art User Interface

- Industrial grade touch-screen controller. 6,5" screen with 65.000 colors
- VGA resolution 640x480 for sharp process graphics
- 1 USB port for printer, 2 PS2 ports for mouse and keyboard, 3 RS 232 ports for external devices
- Methods and runs are saved on a removable flash-card

EasyCONTROL software, simple as 1-2-3

Milestone's new EasyCONTROL software is the most advanced and powerful operating system in the field of microwave sample preparation. Automatic, real-time monitoring and feedback-based control of multiple parameters offers unsurpassed process control. Simply recall a factory stored program or create a new one. Press "Start," and the system will automatically follow the defined temperature or pressure profile, utilizing a sophisticated PID algorithm.



Actual temperature profile. The microwave power is automatically adjusted, based on continuous feedback from the process sensors, to allow the reaction to follow the desired temperature profile.

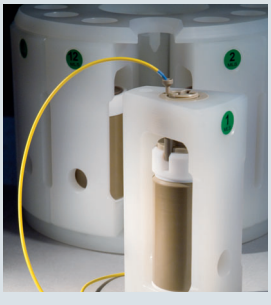
Easy data transfer by EasyDOC Windows-based software

The flash card can be removed from the ETHOS EX terminal and introduced into a standard PCMCIA laptop slot to store, view, and transfer methods and process reporting data.

The ETHOS EX terminal offers the ability to save methods and runs on a Windows-formatted flash card. The flash-card can be directly read by any laptop with a PCMCIA port or, via an adapter, through a USB port. All methods and runs are saved, and can be transferred to/from the hard drive of the computer. Therefore there is virtually unlimited memory for storing all your sample preparation data. Furthermore, with Milestone's Windows™-based EasyDOC software, it is possible to convert the data coming from the ETHOS EX terminal into a standard format readable by any database or spreadsheet software (Excel™, etc.).

Advanced Reaction Sensors

The ETHOS EX is equipped with the most advanced reaction sensors, including direct temperature control in a reference vessel, and contact-less solvent sensor for all vessels simultaneously.



Direct temperature control

The ATC-FO Fiber-Optic Automatic Temperature Control system allows for direct continuous monitoring and control of a reference vessel.

The temperature sensor is housed in a thermowell and protected from chemical attack by a multiple layer of inert PTFE and ceramic, ensuring trouble-free operation.

Contact-less solvent sensor for all vessels

This sensor monitors vapor concentration in the entire microware chamber and effectively controls all vessels simultaneously, preventing any leakage of organic solvents.

Applications Flexibility

Widest Choice of Vessels & Rotors

With its wide selection of rotors, the ETHOS EX can process a wide range of sample volumes and matrices, while addressing your lab's throughput requirements.

Rotor type	Nr. of vessels	Vessel material	Vessel volume(ml)	Max. temperature(°C)	Max. pressure(bar)
SK-12	12	TFM	100	260	35
SK-6LV	6	TFM	270	170	10
PRO-16	16	TFM	75	200	30
PRO-24	24	TFM	75	200	30
MultiPREP	42	PFA	65	200	20

PRO-16/PRO-24 Medium Pressure High Throughput Rotors

High throughput rotor suitable for easy organic samples or environmental applications, according to the U.S. EPA method 3546.

Easy handling and rapid cooling capabilities.

SK-12
Medium Pressure Rotor

General purpose rotor suitable for most samples. The high-strength rotor body holds multiple extraction vessels made of highpurity TFM. Allows for precise and reproducible extractions from virtually any type of sample matrix.

SK-6LV
Large Volume Rotor

Carousel for vessels with 270 mL volume, designed to handle larger samples in parallel, safely and effectively. Larger stir bars are available to facilitate sample mixing.

Microsampling Inserts

For use inside vessels in a 12-position Medium Pressure Rotor.

Ideal for minimizing solvent volumes, small sample processing, and increased throughput.

A large selection of high purity Quartz and TFM inserts is available for all Milestone pressure vessels, for smaller sample amounts or to minimize the dilution factor.

Ethos EX Major Applications

Polymers

Environment

Pharmaceuticals

Agrochemicals

Less Solvent, Shorter Time

PAHs and Pesticides in Soil samples	EPA 3540 (Soxhlet)		ETHOS EX	
	Time required	Solvent consumed	Time required	Solvent consumed
	13.167 hours	450 L	257 hours	16 L
	Comparison study for processing 1.000 samples.			

H. M. Kingston et al., 'Microwave Assisted Organic Extraction and Evaporation: an Integrated Approach'. LCGC, Vol. 20, 2002.

	Time required Soxhlet	Time required ETHOS EX
Additives from Polymers	3 to 16 hours	20 minutes 140° C
Fat from Meat	16 hours	25 minutes 100° C
Impurities in Food Dye	20 hours	1 hours 85° C

Milestone application notes.

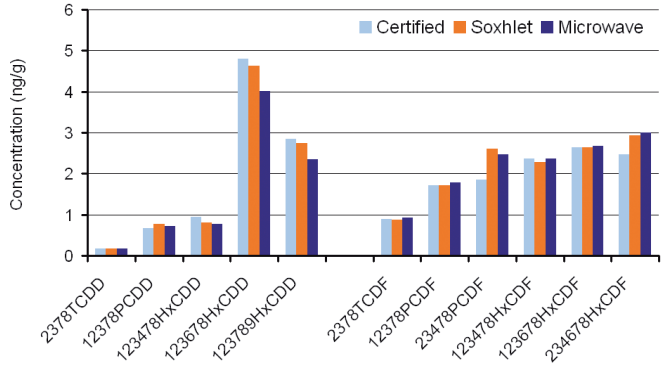
Effectiveness and Consistency

Polybrominated Diphenyl Ethers (PBDEs) from various polymer samples.

RoHS *(Restriction of the use of certain Hazardous Substances in electrical and electronic equipment)* and **WEEE** *(Waste Electrical and Electronic Equipment) directives.*

Method/Sample	Phenol Resin	ABS Resin	PET
ETHOS EX	31.000	2.200	480
Soxhlet	28.000	2.200	460
Total results. All concentrations in ppm. Microwave extraction time: 30 minutes. Solvent: toluene.			

Milestone application notes.



Dioxins and Furans from Fly Ash

Microwave extraction time: 15 minutes. Solvent: toluene.

Post-Extraction Capabilities

Solvent Evaporation & Recovery

With Milestone's patented vacuum evaporation technology, the ETHOS EX turns into a true microwave evaporator, allowing the user to carry out safe and complete evaporation of organic solvents. No sample transfer needed, as the evaporation takes place in the same vessels previously used for digestion/extraction. A complete solvent recovery is ensured by the Milestone's VAC-2000 vacuum module.

Ethos EX

Technical Specifications

Microwave hardware

- Single magnetron system with rotating diffuser for homogeneous microwave distribution in the cavity.
- Magnetron protected from reflected microwave power.
- Installed power 1.200 watts.
- Output power up to 1.200 watts, controlled via microprocessor.
- Large microwave cavity 37 x 34,5 x 33,5 (h) cm.
- Cavity illumination.
- Microwave cavity entirely made of 18/8 stainless steel housing with innovative multi-layer PTFE plasma coating applied at over 350°C.
- All hardware protected against acids/organic solvents with polymer coating both on inside and outside surfaces.
- Total of safety interlocks 4 micro-switches to prevent microwave emission with door open.
- Exhaust located in the side of the cavity, separate from electronics to prevent corrosion.

Reaction sensors

- Direct temperature monitoring and control in a reference vessel.
- Contact-less solvent sensor for all vessels simultaneously.

Control terminal

- Touch-screen industrial grade controller 6,5" screen with 65.000 colors.
- VGA resolution 640x480 for sharp process graphic.
- 1 USB port for printer, 2 PS2 ports for mouse and keyboard, 3 RS 232 ports for external devices.
- Methods and runs saved on Windows®-compatible removable flash-card.

- Weight ~ 75 kg.
- External dimensions 57 x 51 x 61 (h) cm.
- Power 230V/50-60Hz, 2,4 kW.

Standard Methods Compliance

U.S. EPA Methods

EPA Method 3052
Microwave-Assisted Acid Digestion of Siliceous and Organically Based Matrices.

EPA Method 3051a
Microwave-Assisted Acid Digestion of Sediments, Sludges, Soils, and Oils.

EPA Method 3015a
Microwave-Assisted Acid Leach of Aqueous Samples and Extracts.

EPA Method 3546
Microwave Extraction of semi-volatile organic compounds, organophosphorus pesticides, organochlorine pesticides, chlorinated herbicides, phenoxyacid herbicides, substituted phenols, PCBs, and PCDDs/PCDFs, which may then be analyzed by a variety of chromatographic procedures.

ASTM (American Society of Testing and Materials) Methods

D4309-96
Standard Practice for Sample Digestion Using Closed-Vessel Microwave Heating Technique for the Determination of Total Metals in Water.

D-5765
Standard Practice for Solvent Extraction of Total Petroleum Hydrocarbons from Soils and Sediments using Closed Vessel Microwave Heating.

D-6010
Standard Practice for Closed Vessel Microwave Solvent Extraction of Organic Compounds from Solid Matrices.

International Regulations Compliance

Suitable for **RoHS** (Restriction of the use of certain Hazardous Substances in electrical and electronic equipment), **WEEE** (Waste Electrical and Electronic Equipment) and **ELV** (End-of-Life Vehicles) sample preparation.

Specifications are subject to change without notice.

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MICROWAVE LABORATORY SYSTEMS

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Milestone has been active since 1988 in the field of advanced microwave sample preparation. With over thirty patents and more than 9.000 instruments installed worldwide, we are the acknowledged industry leader in microwave technology. Our commitment is to consistently provide the most effective, safest, and highest quality instrumentation for microwave sample preparation. By listening to our customers, we have established a history of developing unique solutions to real-world problems in analytical laboratories around the world.

Ethos EX/00/2006