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CHEMISTS

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# MILESTONE ETHOS UP

High-Performance  
Microwave Digestion System

# MILESTONE ETHOS UP

## High-Performance Microwave Digestion System

It is a common misconception that all laboratory microwave systems are alike and that there are very few differences among them. Though, sample preparation is a fundamental step towards a successful analysis and its importance can not be underestimated. This is why we have incorporated in the new ETHOS UP our vision of the future, our passion, and our knowledge, with the ultimate goal of helping chemists. The ETHOS UP fully embodies Milestone's philosophy in microwave sample preparation. Specifically designed for closed vessel acid digestion, it offers a perfect integration between microwave hardware, user interface, reaction sensors and pressure vessels. The ETHOS UP encompasses Milestone's visionary concept of "Total Microwave Sample Preparation" and, with a comprehensive choice of accessories, it also offers a complete first-class solution for microwave solvent extraction, high-temperature fusion, vacuum evaporation, and even organic and inorganic synthesis or protein hydrolysis. The new ETHOS UP is simply the most advanced yet easy to use microwave digestion system we have ever manufactured. It offers productivity, safety, ease of use, connectivity, expertise and application flexibility.

Milestone's ETHOS UP: towards a higher value.

SAFETY • Best microwave hardware

EASE OF USE • EasyWAVE operating software

PERFORMANCE • tempSURE temperature control and MDR vessels technology

KNOW-HOW AND SUPPORT • Milestone Connect

FLEXIBILITY • Digestion and extraction in the same platform



# BEST MICROWAVE P

**HIGHEST MICROWAVE POWER** • The ETHOS UP is equipped with two 950 Watt magnetrons for a total of 1900 Watt making it the most powerful microwave digestion system available for sample preparation. The system additionally employs a rotating diffuser that evenly distributes the microwaves throughout the cavity. High power coupled with the diffuser enables very fast heating of high throughput rotors and the complete digestion of the most difficult samples.

**LARGEST MICROWAVE CAVITY** • The new Milestone ETHOS UP microwave cavity has a volume of over 70 liters, by far the largest currently available. Why is this important? Firstly, digestion rotors with more sample places can be accommodated, improving both productivity and sample preparation throughput. Secondly, the microwave unit is inherently much safer because a larger cavity contains in a more efficient way gases escaping from vessels, should there be a sudden over pressurization. Some may say that a large cavity leads to a supposed low 'microwave density', lowering the heating rate of high throughput rotors. We at Milestone tend to speak with the evidence of facts. Here aside is a graph showing the heating rate of 44 vessels each with 1 g Soil and 9 mL HNO<sub>3</sub> plus 3 mL HF. 180°C are reached in 10 minutes, in perfect agreement with the US EPA method 3052.



ETHOS UP pressure-responsive door

**PRESSURE-RESPONSIVE DOOR** • The ETHOS UP features a full stainless steel door with an innovative opening and self-resealing mechanism. Should there be a sudden over pressurization of the cavity, the door slightly opens for rapid and safe pressure release and the microwave power is instantaneously cut off. Immediately afterwards, the door is pulled back, resealing the cavity. For additional safety, an automatic door locking system does not allow the user to open the ETHOS UP door during the microwave run. At the end of the run, the door remains locked until the solutions have cooled down to a user preset temperature.

**MILESTONE safeVIEW** • The ETHOS UP integrates the Milestone safeVIEW, a high definition digital camera interfaced with the instrument terminal. It allows the chemist to monitor the progress of the digestion whilst being fully protected by the instrument's all-stainless steel door. A video of the entire run is shown in real time along with the digestion figures.

# PLATFORM

US EPA 3052

T1: 179°C  
T2: 179°C  
(set: 180°C)  
P1:  
P2:  
MW: 0W

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US EPA 3052

T1: 179°C  
T2: 179°C  
(set: 180°C)  
P1:  
P2:  
MW: 0W

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US EPA 3052 typical temperature profile with  
Milestone MAXI-44 rotor

Milestone safeVIEW



# DIGESTION SENSORS

The Milestone ETHOS UP is equipped with the most advanced yet easy to use temperature and pressure sensors.

**TEMPERATURE CONTROL** • The SK-15 rotor, suitable for the most difficult digestions, integrates the unique Milestone tempSURE. The tempSURE combines all the advantages of direct temperature control -precision, accuracy, and continuous feedback (temperature is read 20 times per second), with all the advantages offered by a contactless temperature control system -specifically the possibility of monitoring and controlling all vessels. This is particularly important when dealing with exothermal reactions or simply with unknown samples, where a sequential contactless sensor may not be fast enough to control the reaction.

With the MAXI-44 rotor, typically used for easier and well known applications, a contactless sensor measures and controls the actual temperature of each and every vessel. All temperature profiles are displayed in real time during the microwave run, allowing an instant visual check of the digestion conditions. As low as 5 mL of solution ensures a precise and accurate temperature reading.

**PRESSURE CONTROL** • Direct and contactless pressure sensors monitor and control all vessels simultaneously, preventing any leakage or venting. In combination with our 'vent-and-reseal' vessel technology, these sensors ensure complete and safe digestions without any loss of volatile compounds.

Contactless pressure sensor

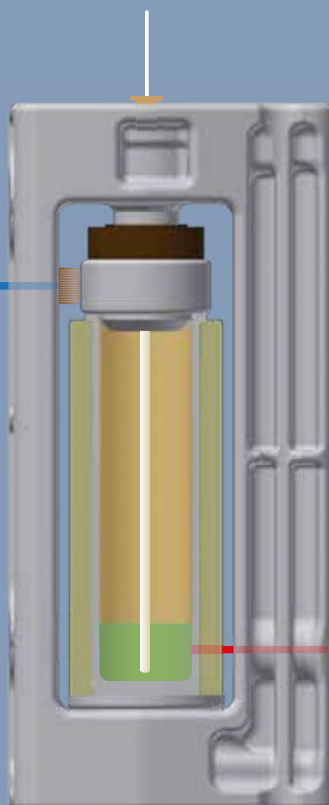


Direct temperature sensor

Milestone tempSURE



Direct pressure sensor



Contactless temperature sensor

SK-15 rotor temperature and pressure sensors

Contactless pressure control



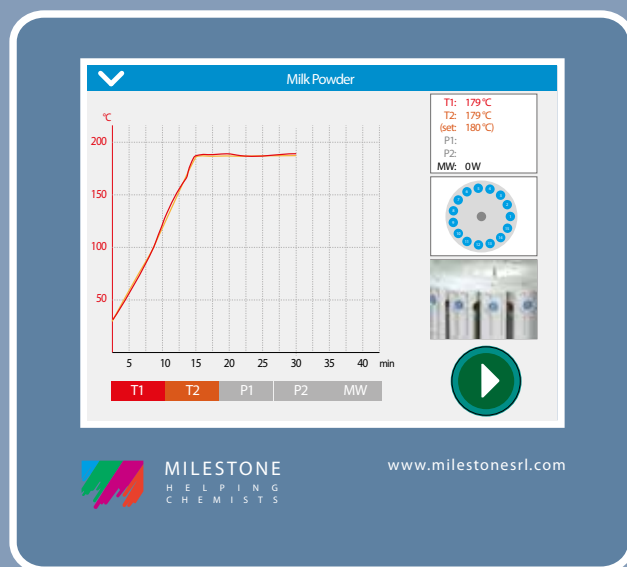
Contactless temperature sensor in all vessels



MAXI-44 rotor temperature and pressure sensors



MAXI-44: temperature profiles for all vessels



SK-15: tempSURE, direct (red) vs. contactless (orange) temperature control



easyWAVE

08  
09

# USER INTERFACE

The ETHOS UP is controlled via a compact terminal with an easy-to-read, bright, full-color, touchscreen display. The terminal is provided with multiple USB and Ethernet ports for interfacing the instrument to external devices and to the local laboratory network.

The terminal runs the Milestone easyWAVE, a completely new user-friendly, icon-driven, multi-language and CFR-21 Part 11 compliant software to provide easy control of the microwave run. Simply recall a previously stored method or create a new one; by pressing 'START', the system will automatically follow the user defined temperature profile using a sophisticated PID algorithm. Hundreds of applications, including all US EPA methods, are preloaded in the ETHOS UP terminal, virtually eliminating any need for method development. Each method includes temperature profile, sample size and choice of reagents. There is no need to input the number of samples, as the software will automatically regulate the microwave power accordingly. This assures a consistent quality of the digestion and simplifies the instrument's use.



Food & Feed

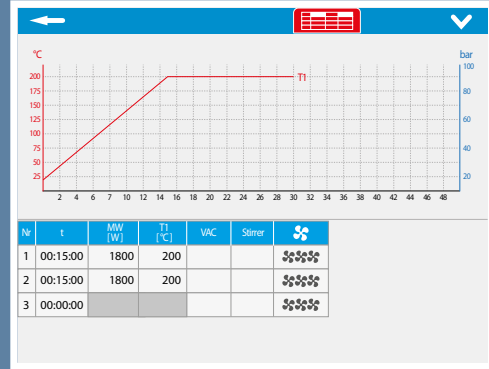
✓ Baby Food	MAXI-44
✓ Barley	MAXI-44
✓ Beech Leaves	MAXI-44
✓ Bovine Liver	MAXI-44
✓ Bovine Milk	MAXI-44
✓ Butter	MAXI-44
✓ Calcium Alginate	MAXI-44
✓ Casein	MAXI-44
✓ Chcolate	MAXI-44
✓ Cocoa Powder	MAXI-44
✓ Cofee	MAXI-44
✓ Corn Starch	MAXI-44
✓ Dried Fish	MAXI-44
✓ Dried Meat	MAXI-44
✓ Dry Infant Formula	MAXI-44
✓ Deed for Fish	MAXI-44
✓ Fish in Oil	MAXI-44
✓ Fresh Meat	MAXI-44



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Hundreds of methods are factory stored



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Editing a temperature profile

Door locked

T1: 21 °C  
(set: 21 °C)

T2: 21 °C

P1: 1.0 bar

P2: 0 %

MW: 0 W

t: 00:50:00



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Easy view of temperature and pressure values

Door locked

S Add R1 R2

T1: 21 °C  
(set: 21 °C)

T2: 21 °C

P1: 1.0 bar

P2: 0 %

MW: 0 W

t: 00:50:00



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Visual indication of temperature in all vessels

test as FS - eludge CRM.dpr

Number of pages: 1



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Methods and runs printed or saved as PDF files

Time	Changes
28.02.17 14:21:01	Seg6=00:02:00/1000W/7210°C/0°C/30.0bar/0/0/3
28.02.17 14:21:11	Start: P Test
28.02.17 15:10:34	P test_20170228_14211.dpr: saved to: A:/Data/P Test
28.02.17 15:26:19	Start: Milk powder_tests elastomer
28.02.17 16:26:24	Program finished
28.02.17 16:44:04	Milk powder_test elastomer_20170228_152619.dpr
01.03.17 08:52:22	Login Admin (Administrator)
01.03.17 08:52:29	test for thermo_mat.fat: File read error.
01.03.17 08:53:32	Start: Milk powder_test elastomer
01.03.17 09:43:47	Milk powder_test elastomer_20170301_085332.dpr
01.03.17 09:58:24	Login Admin(Administrator)
01.03.17 09:59:34	New Method from database: P Test Digestion Agrico
01.03.17 10:01:21	Login (Service)

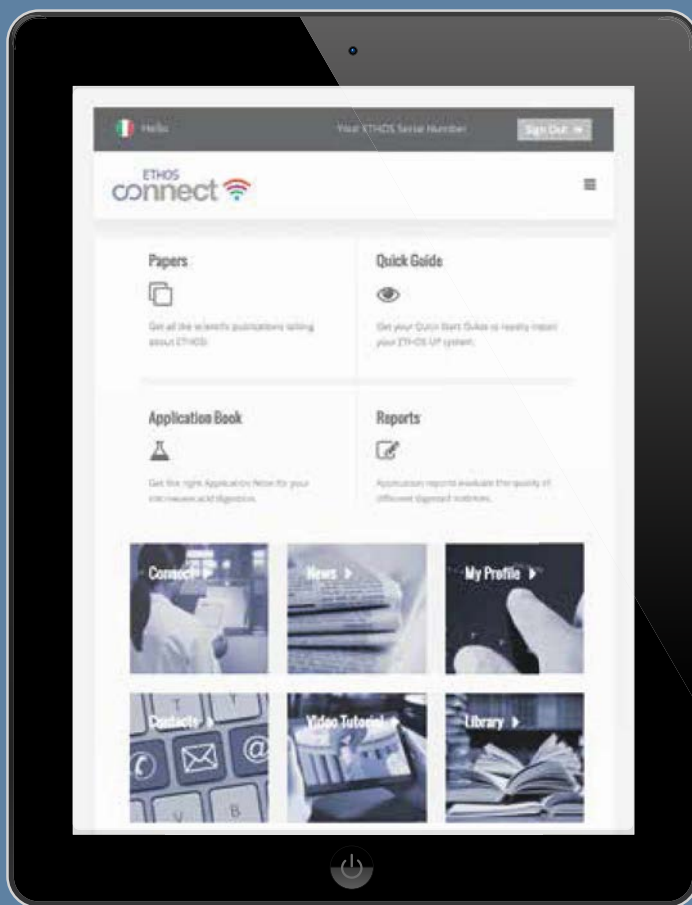


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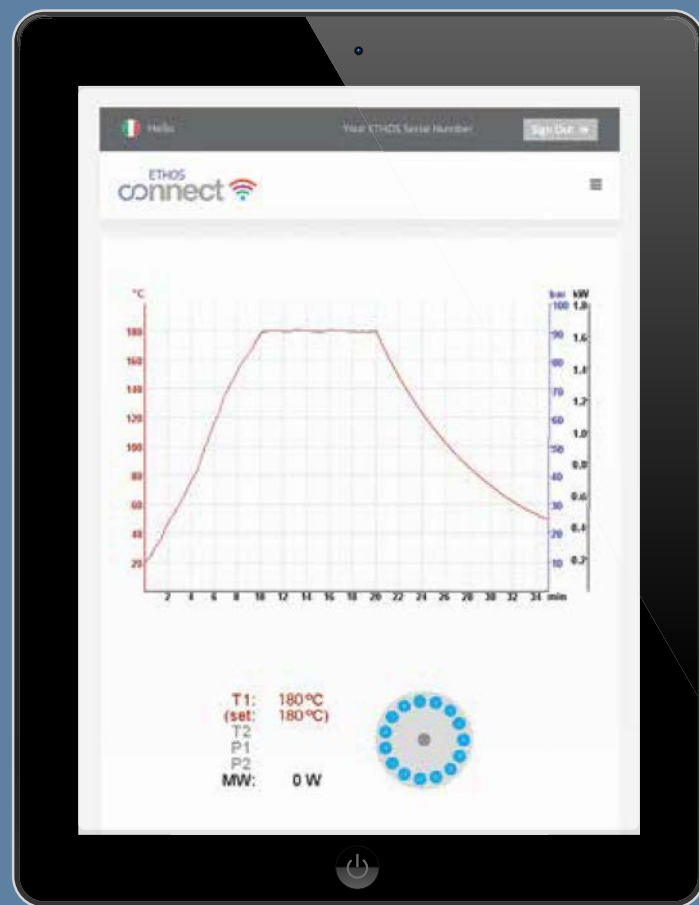
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Instrument's trail tracking (CFR-21 Part 11 compliance)

# MILESTONE CONNECT

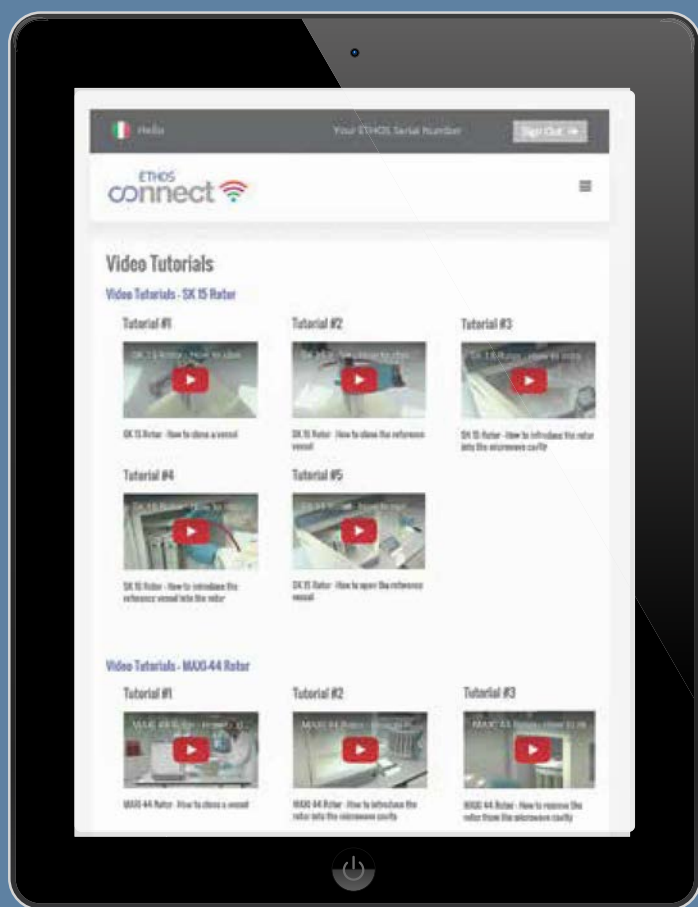


Milestone Connect dashboard

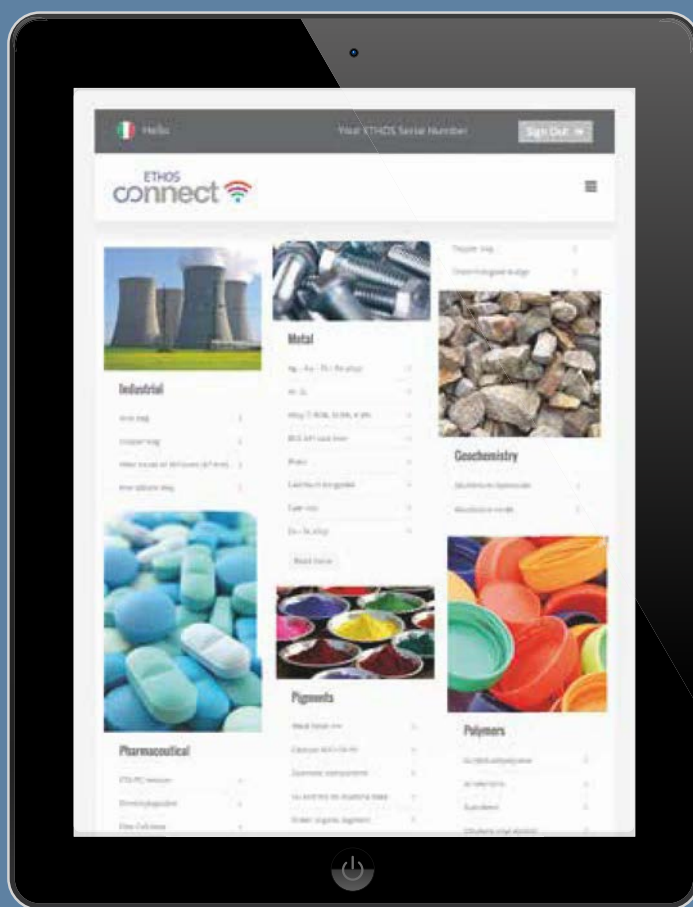


ETHOS UP remote control

SHARING IS CARING • In the new ETHOS UP system, a unique web based application, Milestone Connect, is included. The app provides up to date information and extended instrument control from outside the laboratory with remote monitoring of every sample in the digestion run that ultimately helps to provide high quality sample preparation. The app works on various external devices such as PC, tablets or smartphones connected to the ETHOS UP. The integral database includes specific and detailed information on the installed equipment (list of parts, technical notes, user manual, video tutorials, etc), continuously updated application notes, a library of available scientific articles published in scientific magazines, and a help-on-line section that provides instant support available 24 hours a day, 7 days a week for our users.



Video tutorials



Applications library

# MILESTONE MDR TECHNOLOGY

Two completely new rotors offering both high quality digestion and high sample throughput are available for the ETHOS UP.

**SK-15** • The SK-15 is a high-pressure and high-temperature rotor featuring up to 15 TFM vessels with a volume of 100 ml and suitable for all applications. They include polymers, large sample amounts of food and feed with high fat content, pharmaceuticals, alloys and geological materials.

**MAXI-44** • The MAXI-44 is a high-throughput rotor featuring up to 44 TFM vessels with a volume of 100 ml and suitable for a wide range of samples (typically environmental and food/feed). It is perfect for routine applications, as it combines an unmatched ease of use with the highest sample turn-around-time available today from the market.

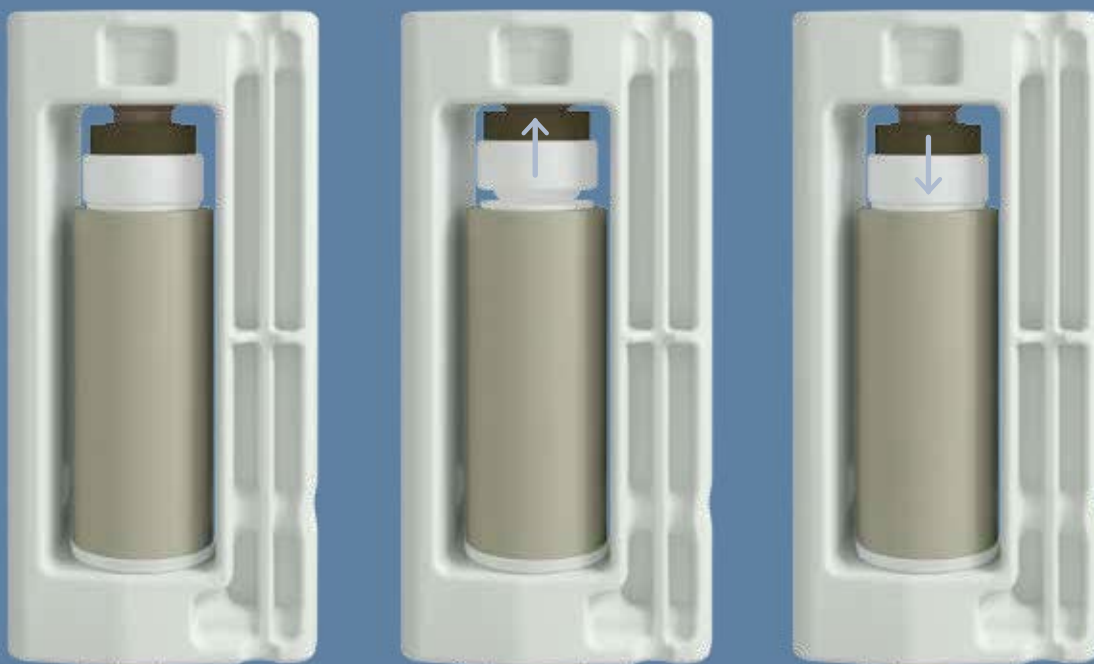
The SK-15 and the MAXI-44 feature the unique Milestone MDR technology for controlling the inner pressure of all vessels in complete safety. This 'vent- and reseal' approach for pressure release is the foundation of Milestone's leadership in microwave digestion. Milestone has in fact pioneered this technology since the early 90's (US Patent 5,270,010), providing the operator with unsurpassed safety and performance capabilities: highest temperature and pressure, highest safety standards, ease of use, and very fast cooling (180°C to 40°C in 10 minutes). While other systems use membranes or burst disks that render a vessel useless after venting, the Milestone system releases only the excess pressure from the vessel. This ensures both no stress to the microwave system's door and no sample loss, as it may happen in case of a membrane or disc bursting.

Finally, a large selection of high purity quartz and TFM inserts are available for the SK-15 and the MAXI-44 rotors for smaller sample amounts or to minimize the dilution factor of the analytical solution.

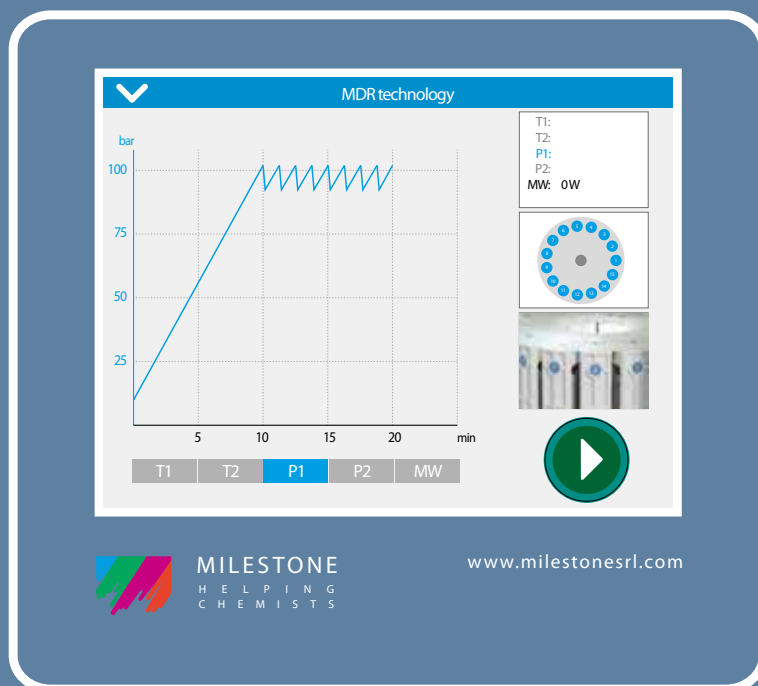
Milestone SK-15 rotor (left), and MAXI-44 rotor (right)



# CHNOLOGY



Milestone MDR technology. A cover's built-in safety spring allows for the venting of the vessel. Once the pressure has been reduced to a containable level, the cover closes again. Only the excess pressure, mainly generated by CO<sub>2</sub>, NO<sub>x</sub> fumes, is therefore released, allowing for a complete recovery of even volatile elements.

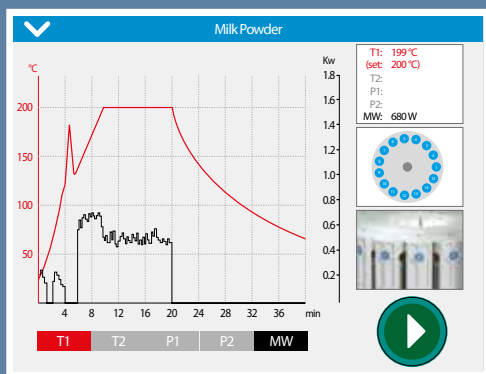


Milestone MDR technology. Notice the typical 'vent-and-reseal' pressure profile.

14  
15



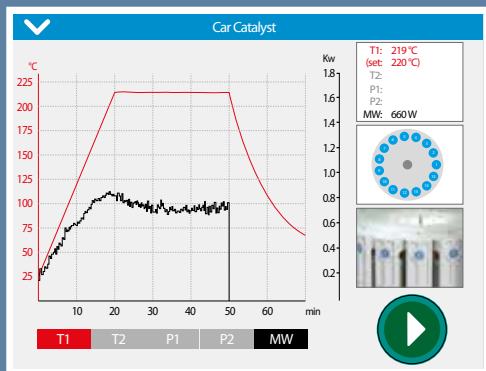
HUNDREDS OF  
APPLICATIONS



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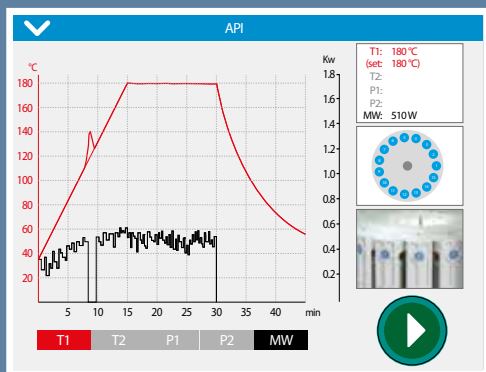
**MILK POWDER** • 2,0 g of Milk Powder samples are digested with  $\text{HNO}_3$  in the SK-15 rotor. Temperature reaches 200°C in 10 minutes and remains at 200°C for 10 minutes. Notice the large exotherm reaction taking place starting from 200°C and the subsequent automatic adjustment of the microwave power, which allows the digestion temperature to return to the desired profile.



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**CAR CATALYST** • 0,25 g of Car Catalyst samples are digested in the SK-15 rotor with a mixture of  $\text{HCl}$ ,  $\text{HNO}_3$  and  $\text{HF}$ . Temperature reaches 220°C in 20 minutes and remains at 225°C for 40 minutes. This digestion method results in a clear solution. A very high digestion temperature is required to fully decompose inorganic compounds, such as ceramics, ores, and rock samples. Therefore, a high-pressure rotor such as the SK-15 is ideal for this type of applications.



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**API (ACTIVE PHARMECEUTICAL INGREDIENT)** • 0,5 g of API samples are digested with  $\text{HNO}_3$  in the SK-15 rotor. Temperature reaches 180°C in 15 minutes and remains at 180°C for 20 minutes. The exothermal reaction takes place after ca. 10 minutes at 130°C. The ETHOS UP operating software automatically lowers the microwave power to regulate the temperature to the set value. This digestion method results in a clear solution. The ETHOS UP is fully compliant with the new USP application methods 232 and 233.



SK-10 • High-pressure digestion rotor, 10 TFM vessels



SK-12 • Medium-pressure digestion rotor, 12 TFM vessels



MAXI-14 • Medium-pressure digestion rotor, 14 TFM vessels

# FLEXIBILITY



ETHOS UP with fastEX-24 rotor





MMR-15 • Evaporation/  
Concentration rotor, 15 TFM  
vessels



fastEX-24 • Extraction rotor  
with 24 disposable glass  
vessels



ultraFAST • High-temperature  
muffle furnace suitable for  
fusions, up to 1200°C

16  
17

The ETHOS UP is a true 'microwave labstation', since several applications can be carried out in the same platform, for instance solvent extraction of organic compounds, such as Chlorinated pesticides, Semi-volatile organics, PAHs, PCBs, Chlorinated herbicides, Phenols, Organophosphorus pesticides, Dioxins and Furans, from environmental samples. When combined with the fastEX-24 rotor, the ETHOS UP processes more samples in less time and uses a fraction of the solvent required by other technologies. It is very simple to use and, following established US EPA and ASTM methods, it assures consistent results with minimal running costs. The fastEX-24 rotor has been specifically developed by Milestone to fully accomplish these applications. This new rotor holds 24 large pressure vessels. At the core of the vessel, there is a disposable and inexpensive 100 mL glass vial. A self-regulating pressure cover assures safe system operations. Temperature and pressure are monitored and controlled in all vessels by non-contact sensors.





# HELPING CHEMISTS





*"We have incorporated in the new ETHOS UP our vision of the future, our passion, and our knowledge, with the ultimate goal of helping chemists."*

Since 1988, Milestone has been active in the microwave sample preparation field. With over 20000 instruments installed worldwide, we are the acknowledged industry leader in microwave technology.

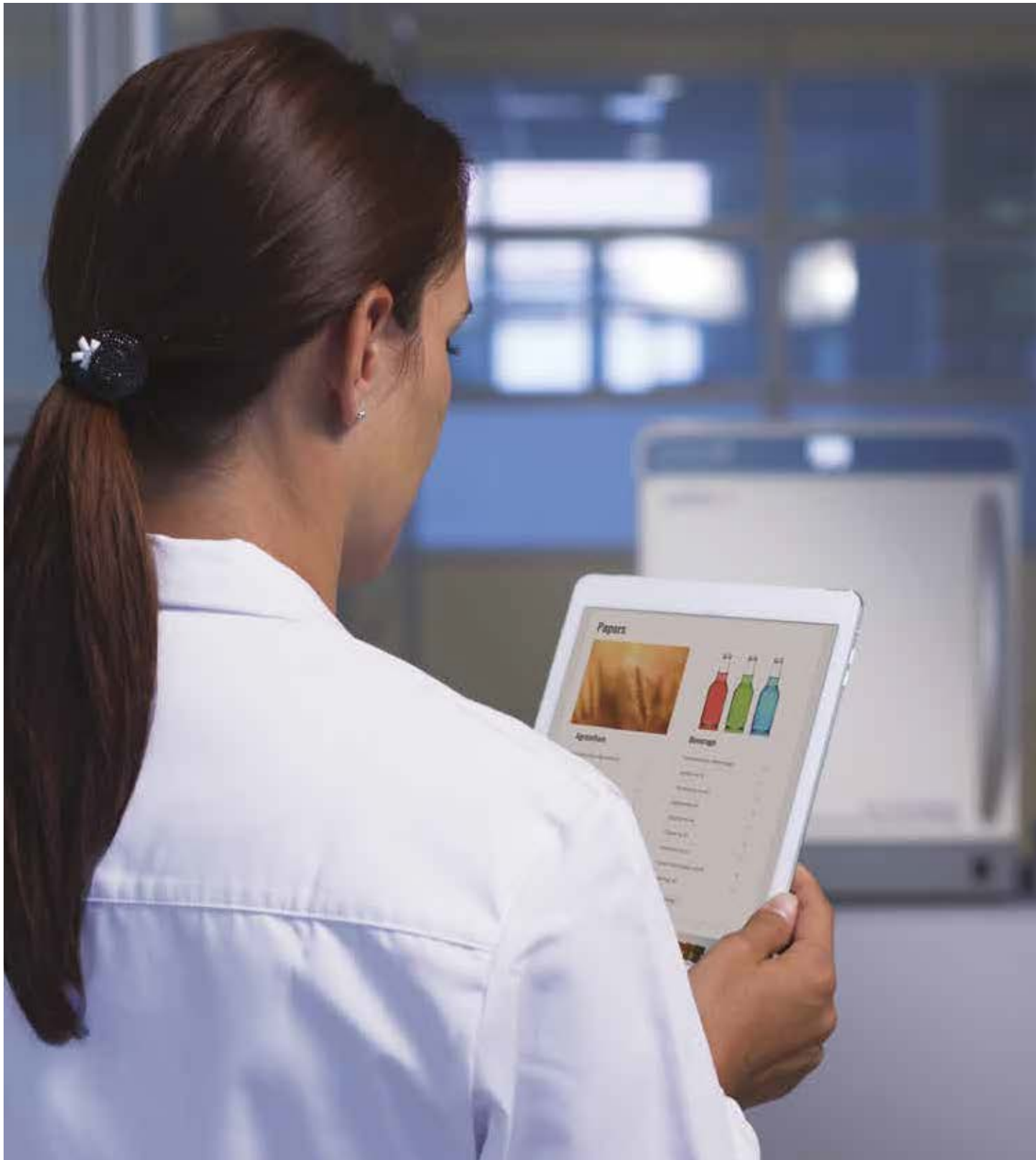
Milestone's vision is to help chemists by providing the most technologically advanced instrumentation for research and quality control.

Our products offer a wide range of applications, such as microwave acid digestion, solvent extraction, synthesis and ashing. Furthermore, we create products for acid purification and direct mercury determination in solid, liquid and gas samples. We offer our customers the highest level of application support, building up over the years a relationship based on trust and commitment.



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