MARS™ 6

Batch Microwave Acid Digestion System

MARS 6 For Digestion

The MARS™ 6 is a microwave acid digestion system that produces clear digestate from samples for elemental analysis by ICP, ICP-MS, or AA. Rocks, plants, soil, foods, pharmaceuticals, plastics, metals, and more can be digested easily, using preloaded methods. For over 30 years, lab technicians have been using MARS systems for sample preparation. With the latest updates to the MARS 6, the process is even easier.

How it Works

Microwave acid digestion is a technique to dissolve metals, bound within a sample matrix, into liquid. This is achieved by exposing a sample to a strong acid, in a closed vessel and raising the temperature and pressure through microwave irradiation. Both the speed of thermal decomposition of the sample, and the solubility of heavy metals in solution are increased. Once these heavy metals are in solution, they can be quantified through elemental techniques. The MARS 6 reduces sample prep time by more than 70%, as compared to traditional techniques.

ONE TOUCH TECHNOLOGY

Pre-installed methods, are one touch away.

By selecting the One Touch™ icon on the MARS 6 touch screen, you'll be able to choose the sample type from the pre-installed methods.Your method includes the recipe for digestion, including: sample size, acid type, and acid volume. From there, it will automatically detect the type of vessel you are using, count the vessels, adjust the power accordingly, and perform the digestion for you. It couldn't be easier.

As Easy as...

Load your Samples

Select your Sample Method

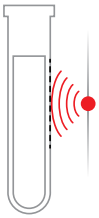
Press "Start"

iWave

Light Emitting Technology (LET)

Better control means better results.

iWave® is a contactless, in-situ temperature technology that measures the sample temperature of each vessel in real-time. There is no need for a control vessel, fiber-optic probes, or wires. This new innovation utilizes Light Emitting Technology® (LET) that determines the temperature of the actual sample, rather than the vessel.



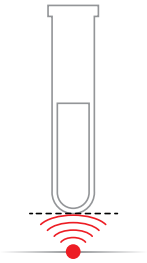
Ok

(non-iWave)
IR sensor from side

Accuracy

Convenience

The temperature is measured from the side at a considerable distance between inner and outer rows. The vessel must be filled to a minimum volume (typically 10 mL) in order to be able to measure the signal.



Good

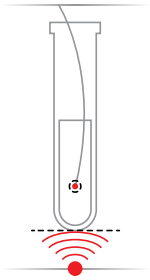
(non-iWave)
IR sensor from below

Accuracy

Convenience

The temperature is measured from the bottom, in close proximity to the vessel. This provides a more consistent signal and the minimum volume in the vessel can be greatly reduced.

IR sensors provide good sensitivity for EPA and other easy to digest materials prepared at moderate temperatures.



Better

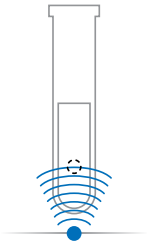
(non-iWave)
IR sensor with fiber-optic probe

Accuracy

Convenience

A probe is submerged, which allows the sample temperature to be measured from the inside of the vessel. This is very accurate, but not very convenient to set up.

A single probe is used in a control vessel and all other vessels have to be calibrated against the control vessel.



Best

iWave

Accuracy

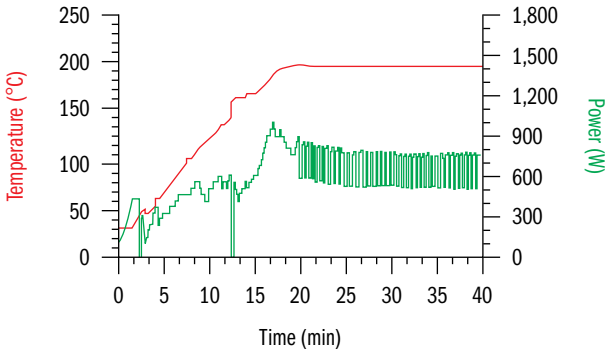
Convenience

iWave is as accurate as an internal probe because it measures the sample and solution directly inside the vessel.

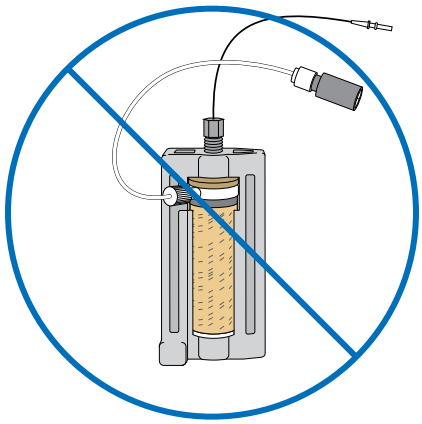
It's like having a fiber-optic probe in every vessel. Every vessel is now a control vessel.

Achieve the accuracy of fiber-optic, with the ease of contactless sensor technology.

Accurate temperature measurement and control is the critical factor in microwave digestion. Achieving precise temperatures reproducibly allows for the digestion conditions to be met and samples to be completely digested time after time.

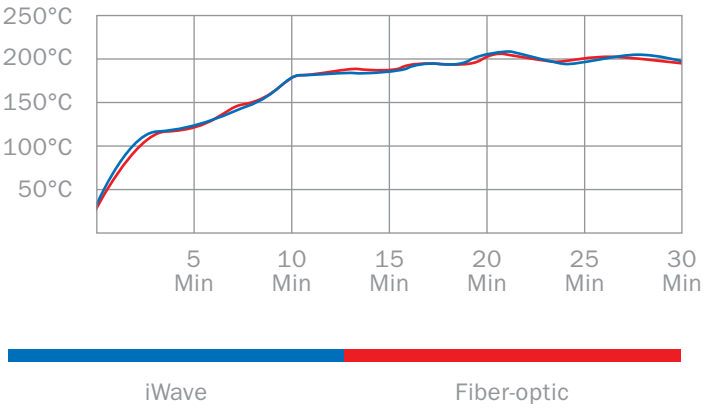


iWave sensors allow for fine power control, as shown in this graph. Temperatures can then be held tighter and digestions are more reproducible.



Probes can be a thing of the past.

Assembling control vessels and making connections are a thing of the past. No more cumbersome assembly of control vessels. No more connecting probes to the microwave. Simply slide the turntable into the cavity and press start.



iWave is as accurate as internal temperature probes.

The data is in. When compared to the industry standard of fiber-optic temperature control, iWave is just as accurate. You get the exact temperature of every sample with precision and simplicity.

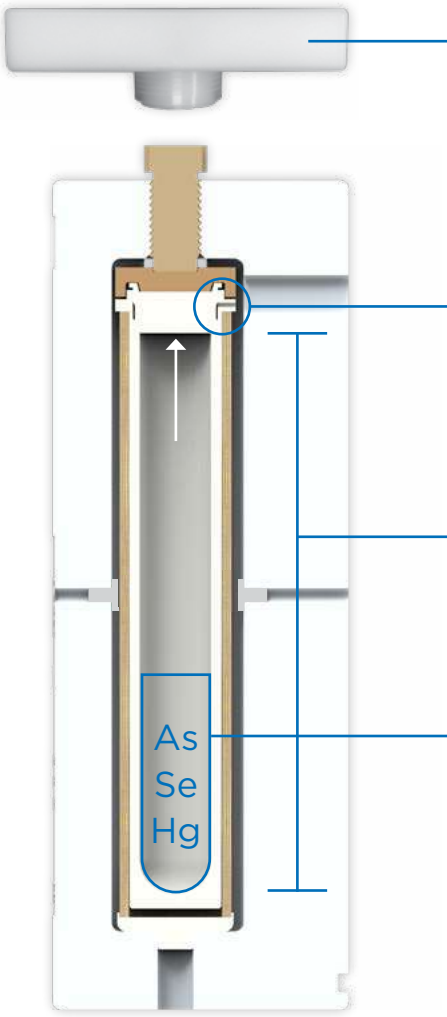
Traditional temperature and pressure control options are still available.

For certain applications, fiber-optic, IR, and internal pressure controls are either more cost effective or necessary to operate certain vessel types. All MARS 6 units are capable of fiber-optic, IR, and internal pressure control. Consult your CEM representative to determine what best meets your requirements.

iPREP

The most advanced digestion vessels ever made.

iPrep™ can digest up to 2x more sample per run, and has higher operating parameters than any other vessel. Larger samples ensure homogeneity and increase limits of detection, a plus for any lab.



Hand Torque Tool

There's no need to use a heavy wrench to assemble iPrep vessels. Our custom fit hand torque tool makes it easy to properly assemble the iPrep vessels, while reducing hand fatigue. One click is all it takes to apply the correct amount of torque, everytime; making it imposible to overtighten or undertighten the vessels.

Dual-Seal Advantage

The high temperature and pressure conditions afforded by this seal and vessel design provide for the complete digestion of difficult organics, such as PET, bunker oil, organic dyes, toner, thermoplastics, and many other difficult to digest materials.

2X Capacity

In addition, its large 110 mL volume allows for larger sample sizes, as compared to other high performance vessels.

Elemental Integrity

The dual-seal function provides for unmatched control of the byproducts from digestions such as CO_2 and NO_x fumes. These are precisely vented outside the vessel, while maintaining the full integrity of all elements, even volatile analytes such as As, Se, and Hg.

MARSXpress

The easiest-to-use, high-throughput vessel on the market, this patented, three-piece vessel assembles in seconds. The open turntable design and composite sleeves allow for quick cooling. MARSXpress™, vessels have a self-regulating pressure control, to eliminate the risk of over pressurization.

EasyPrep Plus

This high-temperature, high-pressure reaction vessel is simple-to-use. EasyPrep™ vessels have fewer pieces to assemble and do not require membranes or springs for reliable pressure control. EasyPrep style vessels provide high temperature and pressure conditions for difficult matrices.

	MARSXpress TFM	**MARSXpress PFA**	**MARSXpress Plus**	**MARSXpress Plus** with DuoTemp	**EasyPrep & EasyPrep Plus**	**iPrep** for iWave
Pressure	Medium				High	Very High
Throughput	High	High	High	High	Moderate	Moderate
Samples	Digests wide range of standard materials				Digests a wide range of standard materials	Digests the widest range of samples at highest sample weights
Main Features	• Simple three-part assembly • Open architecture promotes quick cooling				Can be used with any CEM control option	• 2x sample size • no probes needed • easy-to-use
Temperature Control	IR, iWave	IR, iWave	IR, iWave	IR, fiber-optic, iWave	fiber-optic, iWave	iWave
Vessels	40	40	24	24	12	16
Liner	TFM	PFA	TFM/PFA	TFM	TFM	TFM
Inserts	N/A				quartz & Teflon	Teflon
Volume	55 mL 75 mL	10 mL 20 mL 55 mL 75 mL	110 mL	110 mL	100 mL	110 mL
Typical Application	EPA methods, environmental, food, pet food, feeds, fertilizers, filters, pharmaceutical, nutraceutical, vitamins, tissue, paint chips, clinical, fertilizers, some polymers and edible oils				All MARSXpress samples plus, geological, ceramics, catalysts, precious metals, catalysts, RoHS materials, coal, slags, oils, polymers	All EasyPrep samples plus bunker Oil, PET, flame retardants, and larger sample sizes

Clean Chemistry

Acid Distillation System

Make your own ultrapure acids or water for critical analytical applications, reduce background analyte interference, and save money.

Vessel Inserts

Offered in high purity quartz and Teflon®. Only CEM controls the temperature inside the insert, not the solution in the secondary vessel. This provides a more accurate and reproducible digestion.

3

System pays for itself in less than 3 months

Use less acid volume

Clean acids mean clean blanks

Lower dilution factor

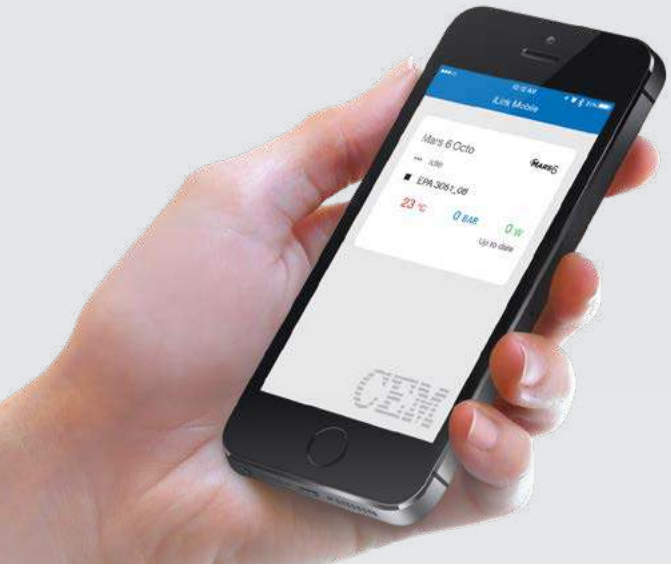
40

Distill up to 40 mL per hour

ppb

Lower analytical blanks

iLink Remote Software Technology



Monitor and control your MARS 6 from your mobile device.

With the iLink® app, you can monitor your MARS 6 and get results on your mobile device. You'll be free to move about the lab, and free to focus on other tasks.

Get it from Microsoft | GET IT ON Google Play | Download on the App Store

How it works

iLink is your 24/7 connection to CEM. Directly connect to CEM from the iLink home screen. Download manuals, application notes, and reference papers at the touch of a button. You are always connected to CEM support with iLink.

Home Screen Advantage

Easily view the most important stats on the home screen such as power, pressure, temperature, and run status.

Run Multiple MARS 6 systems

Control and monitor multiple MARS 6 systems easily from your mobile device. Functions like Remote Start, Stop, Pause, and Run make it simple.

Documentation

Create lab reports with individual vessel statistics, such as Sample ID, Reagents Used, Mass, Volume, Description, and even photos.

Key Features of MARS 6

Construction

Steel Cavity

A solid steel cavity construction, using industry leading 316 stainless steel for durability

Acid Resistant Shell

A high impact, acid resistant polymer shell that is corrosion proof

Spring Mounted Door

A heavy duty spring mounted door that will automatically relieve any pressure from a vessel event

Hardware & Software

Compliant Software

Software is 21 CFR Part 11 compliant for electronic records and signatures

Data Storage

The 8 GB of storage provides more than enough data storage for the lifetime of the system

Ports

- 5 USB ports
- 1 USB-B port
- 2 Ethernet Ports
- 1 RS-232 Port (ensures future compatibility)

Safety Protocols

Temperature Control

The MARS 6 automatically limits the temperature to a safe range, and adjusts, as needed

Auto Shut-off

The PowerMax™ Monitor will shut down the system if full power is applied over a specified time to prevent runaway reactions

Reactiguard

The Reactiguard™ cavity sensing device automatically turns off the system if a vessel event occurs

Ease-of-Use

Training Videos

On demand training videos are available for viewing on the MARS 6 Display

Touch Screen

7-inch glass capacitance, high definition display provides onboard control (no need for external controller or computer)

Vessel Recognition

MARS 6 counts the vessels prior to starting in order to calculate the precise heating conditions required

Specifications

Overall Instrument Dimensions
- 63.5 cm (25") height
- 53.3 cm (21") width
- 63.5 cm (25") depth

Weight
63.6 kg (140 lbs.)

Touchscreen
7" (800 x 480) TFT-LED glass capacitive touchscreen display

One Touch Technology
A combination of vessel recognition and vessel counting sensor technology, software technology, and applications knowledge that enables a user to select a One Touch method that matches their sample type. Based on the sample type, One Touch Technology determines the vessel type and count, digestion temperature, ramp and hold times, and microwave power input.

PowerMAX
Power control technology provides the maximum amount of energy to the sample to ensure complete digestions.

Ports
- 5 USB
- 1 USB-B
- 2 Ethernet
- 1 RS-232

Optional Sensor Upgrades
- Acid sensor
- Solvent sensor
- iWave (In-situ temperature sensor that eliminates vessel probes)
- Pressure sensor

All sensors, including temperature and pressure sensing devices located within the microwave cavity, are microwave-transparent or shielded to ensure accurate readings and to eliminate arcing (ignition) hazards.

Optional Hardware Upgrades
- Camera
- Automated Capping Station
- Door Lock

Software
- iLink remote control (optional)
- Windows, Android, Apple compatible allowing 24/7 access to information

Software Languages
- English
- German
- French
- Italian
- Spanish
- Chinese
- Japanese

Sample Stirring
In-vessel magnetic stirring of samples at three levels of speed.

Turntable Design
PerfectCircle™ design provides absolute radial symmetry. Turntable operates in alternating or continuous mode.

Inlet/Outlet Ports
Standard 0.500" I.D. port or optional 0.3125" I.D. ports for 0.250" (6mm) tubing

Microwave Cavity
Heavy-duty, 316 stainless stell multi-layer Teflon® coating

Electrical Requirements
- 200/208/230 VAC (200-253 VAC), 60 Hz, 15A @ 230 VAC
- 220/240 VAC (202-250 VAC), 50 Hz, 15A @ 240 VAC

Magnetron Frequency
2455 MHz

Installed Microwave Power
2000 W dual magnetrons

Magnetron Protection
Solid-state isolator (US patent 4,835,354) to protect magnetron from reflected energy, ensuring constant power output.

Speakers
8 Ω, 2 W, 86 dB

Printer
Onboard thermal printer and USB-B compatible printer port

Safety Features
Four independent door safety interlocks, including an interlock monitoring system plus three independent thermal switches, are used in each instrument to prevent instrument operation and microwave emissions in case of improper door closure or misalignment. The instrument complies with HHS standards under 21 CFR, Part 1030.10, Subparts (C)(1), (C)(2) and (C)(3). Reactiguard continuously monitors the cavity and disables the magnetron if disturbances occur inside the cavity. Optional door lock prevents door from being opened during microwave run.

Emissions and Safety Approvals
Europe/Global Community Conforms to EN61010-1 (Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use Part 1) Conforms to EN61326-1 (EMC requirements for Electrical, Control and Laboratory Use)

United States Complies with FCC Part 18 regulations (47CFR part 18: Industrial, Scientific and Medical Equipment) US Safety Approval to UL61010-1 (ETL Testing Laboratories)

Canada Complies with FCC Part 18 regulations
(47CFR part 18: Industrial, Scientific and Medical Equipment) Canadian Safety Approval to CAN/CSA C22.2 No. 61010.1

Patents
CEM microwave systems and vessel designs may be covered by any one of the following US patents: 04835354, 04080168, 05369034, 04672996, RE034373, 05230865, 04877624, 04672996, 05206479, 05427741. Other patents pending.

Over 50,000 systems sold worldwide

CEM has been an ISO-certified facility since 1994

All systems serviced & supported by experts with an average of 15 years of experience

CEM invests 11% of annual revenue into R&D, the result... 11 R&D 100 awards

IQ/OQ/PQ Validation by certified CEM Technicians

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