hs·tumbler®
Trajectory Mixer

Trajectory mixer K1

Stirrer-free, ultra-flexible high-performance laboratory mixer

High Performance in the Lab: The Trajectory Mixer

Programmable trajectories

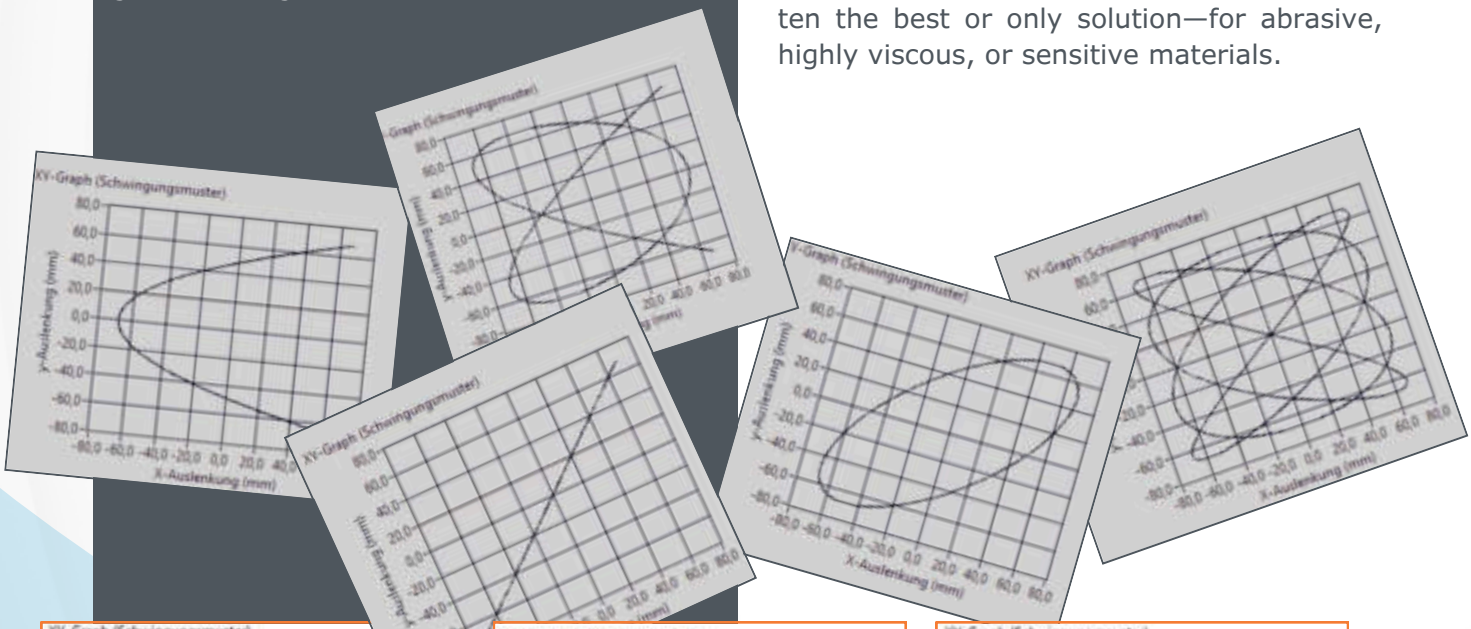
The process utilizes programmable motion paths along which the mixing material is moved at high frequency within a hermetically sealed chamber. These highly complex motion patterns —so-called Lissajous figures —create a predefined "roller coaster-like" trajectory that generates intense shear forces and enables both homogeneous and gentle mixing.

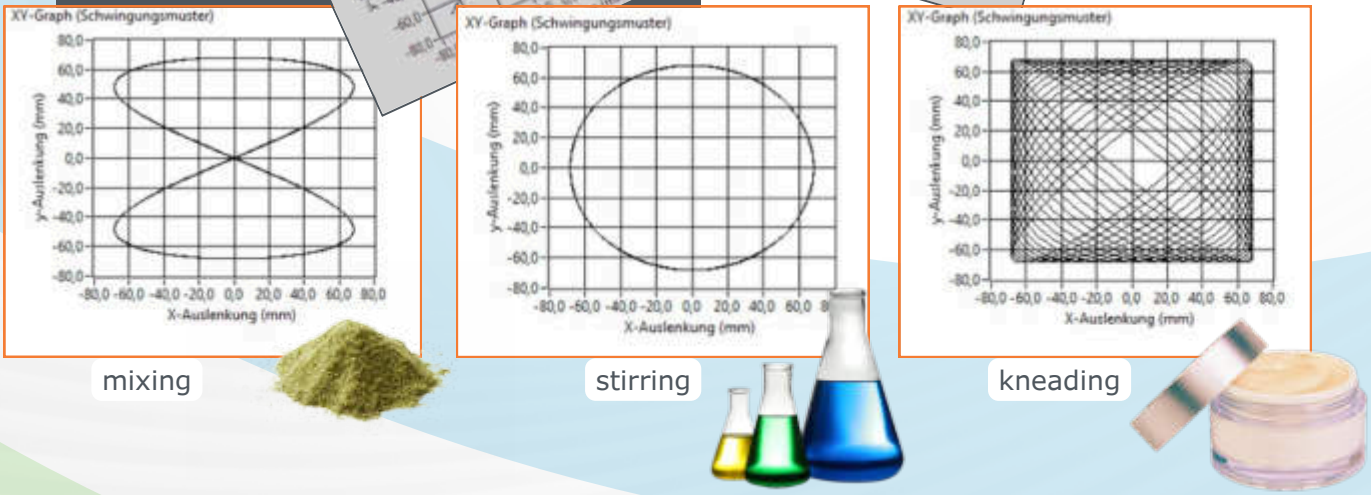
Without stirring and kneading tools

The system operates in its standard application without mechanical stirring or kneading tools and replaces conventional agitator types such as whisks or dough hooks with freely programmable motion profiles. By eliminating mechanical tools, the risk of overprocessing and contamination is significantly reduced.

Mixing of substances through shear forces

Trajectory mixing is characterized by its versatility in processing solids, liquids, and gases. It is particularly well-suited—and often the best or only solution—for abrasive, highly viscous, or sensitive materials.





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Trajectory Mixer

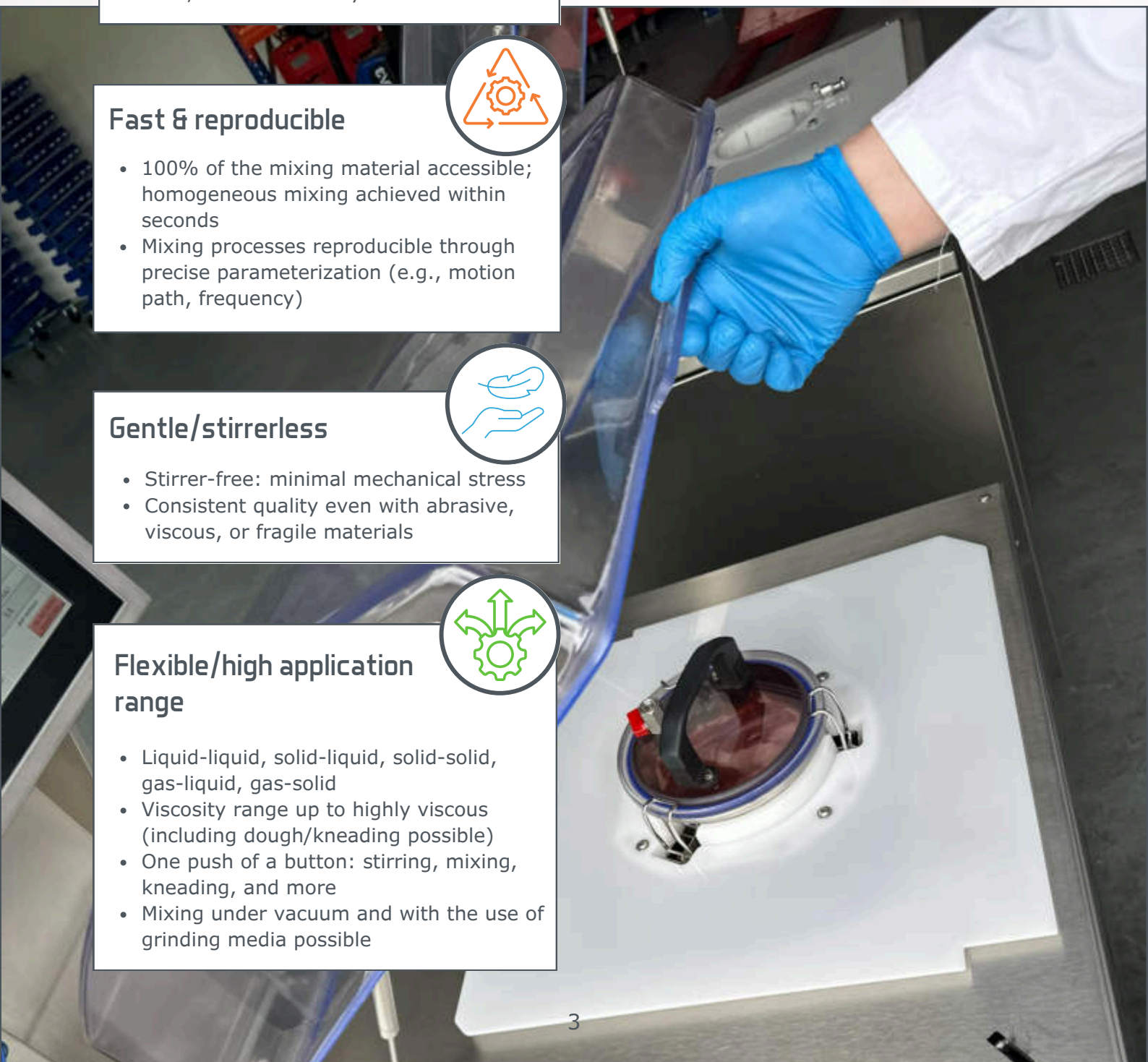
KI Trajectory Mixer - New Possibilities in the Laboratory

Container change

- One container from dosing to completion, no need for transferring
- Wide selection of application-specific containers
- Containers are sterilizable, dishwasher-safe, and hermetically sealed

Large volume/Scalable

- Filling volume: 500 ml – 4,000 ml
- Filling weight: up to 6 kg
- Scalable: from laboratory to production



Fast & reproducible

- 100% of the mixing material accessible; homogeneous mixing achieved within seconds
- Mixing processes reproducible through precise parameterization (e.g., motion path, frequency)

Gentle/stirrerless

- Stirrer-free: minimal mechanical stress
- Consistent quality even with abrasive, viscous, or fragile materials

Flexible/high application range

- Liquid-liquid, solid-liquid, solid-solid, gas-liquid, gas-solid
- Viscosity range up to highly viscous (including dough/kneading possible)
- One push of a button: stirring, mixing, kneading, and more
- Mixing under vacuum and with the use of grinding media possible

Mixing containers: simple, flexible and hygienic

One container, one batch – for fewer work steps

Mixing, homogenizing, grinding, dispersing, etc. — all blending processes occur (in a seamless transition) within the same container. Simply switch between different mixing modes at the push of a button. This eliminates the need for transferring, additional tools, and cleaning steps.

One product, one container – for better hygiene

Each product can be processed repeatedly in the same container, thereby eliminating intermediate cleaning steps. Additionally, contamination with other substances is prevented.

Technical data

	HST Trajectory Mixer K1
Applications	Mixing of powders/granulates, production of suspensions, milling processes, emulsification, and more
Specification	Single-container system
Connection voltage	400 V - 50 Hz
Dimensions (W x D x H)	800 x 800 x 1.450 mm
Power consumption	max. 4,5 kW
Electrical fuse protection	16 A, residual current device (RCD) Type B+ required
Weight	ca. 750 kg
Emission sound pressure level	LpAeq < 78 dB(A) (A-weighted equivalent continuous sound pressure level)
Drive	2x servo motors, each 2.21 kW
Control technology	Intuitive operation via touch screen
Safety technology	• Fully enclosed design with safety hood • Safety hood locked in de-energized state (NC – normally closed) • Emergency stop button
Optional components	• Process containers with various geometries and materials • Vacuum generator, hoses, and connectors
Remote maintenance	TeamViewer V10
Machinery directives	Compliance: 2006/42/EC; EC Declaration of Conformity; CE marking
Container	• Variant 1: 4.58 l; Variant 2: 3.75 l; Variant 3: 2.29 l
Product-contact parts	All product-contact parts are food-grade (FDA-compliant) • Container: Stainless steel • Seal: Silicone • Lid: PETG
Vacuum	• Vacuum generator (optional): Connection via valve in lid (0 – 99%) • Vacuum generator not included with the machine
Optimal filling volume	Depending on the process material, 20% to 85%
Operation	Manual

Extras and accessories

Containers and lids in application-specific feeders

The design and surface structure of mixing containers have a decisive influence on the shear behavior within the product. Together with the process parameters, they significantly determine the homogeneity and quality of the final result. For your experimental series, we design a specifically optimized container geometry that ensures consistent conditions and reliable results.

Container trolleys - efficiency & safety when changing batches

For safe, ergonomic, and organized transport of individual mixing containers, we recommend using our specially designed container trolley. It not only facilitates handling of the containers but also enhances order and structure in the production environment —especially during frequent batch changes. The container trolley enables controlled and energy-saving transport, reduces the risk of contamination, and supports a smooth, time-efficient workflow in daily operations.

Vacuum unit - for maximum product quality & process reliability

If you want to reliably avoid air inclusions, reduce oxidation, and achieve an especially homogeneous product mass, the use of an optional vacuum unit is recommended. Evacuating the process container not only significantly improves mixing quality but also expands the application range of the trajectory mixer, particularly for sensitive, viscous, or reactive products.

HMI

The modern Human-Machine Interface (HMI) enables simple and precise control of all relevant process parameters—from mixing speed and motion path to mixing time. Product-specific programs can be conveniently saved, managed, and recalled at any time, supporting reproducible results and efficient batch changes.

Additionally, the HMI offers features such as multi-level user management, password protection, logging of operational data, and clear-text error messages. This not only ensures high process safety but also meets requirements for traceability and quality assurance.

Mixer as ball mill

Without grinding media, the trajectory mixer is a gentle mixing system. Only through the use of optional grinding media is effective size reduction enabled, which can be optimized by the material and size of the beads. By selecting different curves and ellipses, the force and behavior of the grinding process can be flexibly and dynamically adjusted.

K1-Thermo - gentle tempering in seconds

In the thermal version, the K1 heats during mixing with up to 6 kW of heating power. Due to the large heat transfer area (via the jacket) and the rapid material exchange at the surface, an optimal heat transfer with minimal delta-T is achieved. Powders or doughs can thus be heated in a very short time.

Technical Data:

- Heating power: 6 kW
- Temperature range: up to 150°C

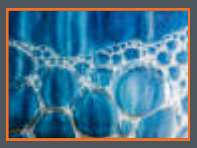
heating segments (heating jaws) of K1-Thermo

Applications

High viscosity fabrics

Powder and solids

Slurries and doughs



Liquids and emulsions

High viscosity fabrics

- **Fast mixing without overheating:** Every high-viscosity mixing process requires the phases of wetting, incorporation, and blending. In the final step, traditional stirring technologies fail as viscosity increases—they either overheat or stall. In contrast, trajectory mixing technology performs all three steps simultaneously and evenly throughout the entire container, significantly reducing processing time.

- **Gentle mixing regardless of viscosity:** Trajectory mixing is a contactless method that operates without stirring blades or mechanical devices. This avoids high shear stress on highly viscous materials, enabling faster processing of sensitive or hazardous substances without heat generation or shear damage.

- **High-quality results even at high viscosity:** The higher the viscosity, the more difficult it is to achieve a uniform mixture with conventional methods, often resulting in insufficient dispersion. Trajectory mixing overcomes these limitations at any scale. Additionally, mixing parameters can be optimized through va-cuum, temperature control, and other accessories, making the mixing of highly viscous materials more effective at elevated temperatures and under vacuum.

Overview of industries

Slurries and doughs

- **Rapid suspension formation:** Every liquid-solid mixing process requires wetting, incorporation, and finally actual blending. Without forcing all materials through a limited mixing zone using propellers, trajectory mixing technology performs all three steps simultaneously and evenly throughout the entire mixing vessel. This significantly reduces processing time.

- **Flexible dosing of ingredients:** Trajectory mixers allow the simultaneous addition of multiple ingredients without a fixed sequence. The homogeneous mixing throughout the entire container eliminates time-consuming individual steps and separate pre-containers. Addition errors and cleaning efforts are significantly reduced.

- **Improved stability of suspensions:** The superior results of trajectory mixing contribute to better suspension quality and long-term stable compositions. Solid particles that tend to clump or settle out of the suspension are better dispersed and therefore remain suspended longer—sometimes even permanently.

Applications

Powder and solids

- **Fast, homogeneous mixing:** Since the entire batch is processed simultaneously, extremely rapid and uniform mixing is achieved.
- **Extremely gentle:** Because the trajectory mixer operates without stirrers, mechanical damage can be avoided. Especially gentle motion paths are also available for particularly sensitive products.

Liquids and emulsions

- **Fast, Complete Mixing:** Traditional mixing methods create local vortices around stirrers, requiring the liquids to pass through small mixing zones multiple times. In contrast, trajectory mixing brings the mixing action directly to the material – for immediate, uniform, and efficient blending. It enables stable emulsions, complete distribution of even the smallest ingredients, and rapid processing of a wide range of liquids.
- **No Sequential Ingredient Addition Required:** Trajectory mixing does not require a fixed order of ingredient addition. This technology also ensures uniform, continuous mixing while reducing both addition time and the risk of errors. In addition, it eliminates nearly all cleaning effort associated with separate containers.
- **Extended Shelf Life:** The superior results of trajectory mixing contribute to better suspension and a more stable long-term composition of many liquid mixtures.

Services

- **Product Testing:** We process your product in our laboratory – giving you a clear view of the possibilities trajectory mixing offers for your formulation.
- **Parameter Analysis:** We determine the optimal mixing parameters for your product (trajectory shape, speed, etc.).
- **Container Optimization:** We develop the ideal container for your product (shape, material, surface).
- **Training:** We prepare you and your team to work confidently and effectively with the trajectory mixer.
- **Maintenance and Repair:** Fast service from experienced technicians – reliable and competent.

About hs-tumbler

hs-tumbler GmbH is an innovative mechanical engineering company based in Quakenbrück, Germany. With a dedicated team of 15 employees, the company develops and manufactures state-of-the-art trajectory mixing systems for demanding applications across a wide range of industries.

The inventor of the trajectory mixer and managing director, Bernhard Hukelmann, personally stands for the technical excellence and innovative strength of the company. hs-tumbler combines practical solutions with forward-looking technology – Made in Germany.

Future-proof mixing

The trajectory mixer represents a modern, sus-ainable, and future-proof mixing technology. Thanks to its energy-efficient design, it meets the highest standards for **green technology**. With **AI compatibility** and optional **AI upgrades**, the mixer can be intelligently enhanced – enabling automated process optimization and maximum efficiency. **Customizable programs** keep the system flexible and allow for quick adaptation to new products or processes. This means you are investing in a solution that meets the highest demands – not just today, but also in the future.

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