

# ULTRASONIC LABORATORY DEVICES



**hielscher**  
Ultrasound Technology

## compact, high-efficient, robust



UP400S and UP200H with timer

As desk-space in the laboratory is expensive we supply ultrasonic processors in a compact design: Power supply, generator, control and transducer, all of which are located in an aesthetic housing. No additional cables impede.

The operation of our ultrasonic processors is most simple. The amplitude and therewith the power can be adjusted from 20 to 100%. The sonication time within a second is adjustable from 0.2s up to 1.0s (steady state), so that problems as regards the heating-up and foaming can be avoided. The automatic determination of the ideal frequency makes a manual precision adjustment unnecessary. Independent of the sonotrodes load, the adjusted amplitude remains constant. That creates reproducible conditions and also high robustness as the devices are then steady-state proof even when operated in air.

The well-priced standard devices can be retrofitted with suitable accessories

at any time. Diverse sonotrodes, flow cells, sound protection boxes and a timer are part of the standard program. By means of a PC-control the given test parameters can be displayed and the test results, in particular the resulting power and energy input in the liquid as well as the temperature can be recorded.

The selection of the ultrasonic processor and sonotrodes mainly complies with the volume of the samples to be sonicated. The offered power range for the laboratory includes devices of 50, 100, 200 and 400 watts and is suitable for small droplets but also for several liters. For bigger volumes we offer industrial processors with a power range of up to 16kW per unit.

Should your demands exceed our standard range, please contact us, so that we may design a special solution made to your requirements.

## versatile applications

Ultrasonic processors for laboratories are mostly used, when preparing samples for analysis. In addition to that, the development of new techniques on the basis of the cavitation effect is getting more and more important. In order to support research work we lend laboratory devices on very good conditions and offer for the following scale up our experience and the required technology.

In biology, biochemistry, biotechnology and in the medical range ultrasound is used for the **disrupting of cells** and **homogenizing** of samples. Muscle tissue, liver tissue or lymphocytes as well as vegetable cells can be disrupted for analysis purposes or for the use of their contents. The sonotrodes can be treated in autoclaves and can be cleaned easily due to their simple geometry, so that contamination does not take place. For special application cases we offer devices and accessories for indirect sonication, so that the sample stays isolated.

The separation of viruses from bacteria or the **extraction** of active agents from vegetable cells are exemplary for the practice in the pharmaceutical industry.

In the food industry cheese, meat and sausage samples, fruits, or vegetables are homogenized in order to test the quality for consumer protection. In this branch of industry ultrasound is also used for the production of oil/water emulsions, in which very fine droplet sizes of under 200nm can be achieved. The **degassing** of beverages is useful for analysis. The **reducing of germs** in liquids is already possible in low temperatures by the use of ultrasound. Environmental standard tests are the homogenizing of water-, waste water- and soil samples in order to detect or determine oils, radio-active parts or the content of fertilizers. Ultrasound can also be helpful in the conversion (transesterification) of biodiesel from vegetable oil. There it can reduce the amount of catalyst needed and it can

improve the biodiesel yield.

In the chemical industry ultrasound is used for the production of **suspensions, emulsions**, for the interference of crystallization or polymerization and for the acceleration of chemical reactions or **dissolving** processes.

**Disagglomerating** and **sieving** by means of ultrasound are applications, that are in particular helpful, when manufacturing coatings.

A better permeation of pigments and an even distribution can be reached with ultrasonic applications such as wet coloring and impregnating.

**Cleaning** is the most common ultrasonic application. The following described laboratory devices can also be set in use for special cleaning tasks that demand a high ultrasonic intensity on small surfaces e.g. bores can be cleaned by ultrasound, when using thin-bodied sonotrodes.

## VialTweeter at UIS250v intensive sonication of vials

The VialTweeter is an effective means for the sonication of vials, storage vials and reagent vials without the need to open the cap or any water bath.

The VialTweeter delivers up to 10 watts to each of the six vials in its high intensity part and up to 5 watts to the two vials placed in its low intensity part. These power levels allow for sophisticated sonication processes in short time, similar to direct sonication by a homogenizer. The VialTweeter can sonicate a test tube, bottle or beaker of up to 500ml volume attached to its end, too. The power can be adjusted by means of the amplitude adjustment at the front panel of the generator.

Once set, the amplitude will be maintained at the adjusted value and is distributed evenly across the 6 high intensity vials and the 2 low intensity vials, respectively. This gives you reproducible sonication effects.

This compact and reliable unit is easy to set-up and operate. As the ultrasonic generator is tuned to the frequency of the sonotrode automatically, there is no manual frequency tuning required. For a good transmission of the ultrasonic vibrations to the individual vials, the vials are pushed gently into the holes of the VialTweeter. The VialTweeter vibrates through the vial/vessel wall. Hence, the vial can remain closed. Different from the direct sonication by means of an ultrasonic sonotrode that is immersed into the liquid, this eliminates cross contamination of samples. It reduces the time required per vial/vessel.

The VialTweeter can be cleaned and disinfected easily. The VialTweeter is autoclavable and the transducer of the UIS250v is made of stainless steel (IP65, NEMA4). The generator is connected to the transducer by a 4m connection cable. Alternatively to the VialTweeter, the UIS250v can be equipped with sonotrodes for direct immersion into liquids. In that way, the UIS250v can be used as a hand-held or stand-mounted homogenizer.



VialTweeter (front) and sonotrode (back) at ultrasonic processor UIS250v

## UP50H ideal for small volumes



UP50H with sonotrode MS7

The ultrasonic processor UP50H (50 watts, 30kHz) is the smallest model of our aesthetic laboratory devices, that are only supplied by Hielscher Ultrasonics in that compact form.

The UP50H is used in particular in medical, biological or chemical laboratories, in which small volumes are to be sonicated. Application fields are to be found mainly in the analytical field with applications such as the disruption of tissues, the cracking of bacteria or the homogenizing of samples in the food industry.

Even if this device is perfectly suited for manual operation with its only 1.1kg, it can also be operated with stand. For volume samples from 10µl up to 250ml we offer various replaceable sonotrodes with diameters from 0.5 to 7mm. Further accessories such as flow cells made of stainless steel or glass, timers or our PC-control are part of our standard program.

## UP100H double power for small additional charge



flow cells GD7K and D7K

The ultrasonic processor UP100H (100 watts, 30kHz) has the same dimensions as the UP50H but it is suited for the double power output. With the use of the 10mm sonotrode the field of applications expands to applications with volumes of up to 500ml.

All other features and standard equipment are equal to those of the ultrasonic processor UP50H.

Therefore this device is ideal for applications with very small as well as medium-sized samples as e.g. samples for the homogenizing of soil or waste water, emulsifying, disagglomerating, degassing or the cleaning of small bores.

For continuous operation only a flow cell and the appropriate 7mm sonotrode is required. Continuous processes in the smallest scale can be simulated. The optional PC-control may be helpful, if a test record is necessary or to optimize processes.



UP100H with MS3

## UP200H powerful and aesthetic



The ultrasonic processor UP200H (200 watts, 24kHz) is the most powerful hand held device. It can be mounted to a stand, too. The exceptionally progressive design was rewarded with the International Designer Award in 1995. Since then this device is the flagship under the compact laboratory devices of Hielscher Ultrasonics.

Sample volumes from 0.1 to 2000ml can be sonicated with sonotrodes of diameters from 1 to 40mm.

The power is also sufficient for the indirect sonication of samples. Therefore the sonotrode is immersed into a sonication beaker, transmits the oscillations in distilled water, that are reflected to a titanium cone and then transmitted to the test tubes with the sample.

We offer a comprehensive range of accessories for the UP200H such as flow cells, stand, sound protection box, timer and PC-control.



UP200H with S7

## UP200S well-priced and robust



cavitation at S40

The ultrasonic processor UP200S (200 watts, 24kHz) differs from the UP200H only with its shape and its use only with stand.

The device is suited for sample volumes from 0.1 to 2000ml. Therewith the fields of use comprise the sonication of very small samples in medical or biological laboratories up to bigger samples in the chemical or environmental range.

It is also used for the production of smaller quantities, mostly in continuous flow with the use of flow cells and the appropriate sonotrodes.

As all our laboratory devices the UP200S finds its customers worldwide. Without any additional fees we supply our devices for local power supplies from 100 to 240V and with the corresponding plugs.



UP200S with S40

## UP400S for bigger samples and application development



UP400S with H22 in sound protection box

The ultrasonic processor UP400S (400 watts, 24kHz) is our most powerful laboratory device. With sonotrodes of a diameter range from 3 to 40mm the device is suited for sample volumes from 5 to 4000ml. In flow approx. 10 to 50 liters per hour can be treated. For the preparation of test portions the UP400S is mainly used for bigger volumes. It is suited for the practical process development in the laboratory but also in the college of technology as well as for the production of small quantities. For production quantities a PC-control or a connecting lead to a central control of the user's plant is recommended in order to raise the process safety. With special flow cells and flange connections liquids can also be sonicated at high temperatures and pressures.

High power generates the intensive cavitation required, but this results in unwanted noise. For operating the UP400S we recommend to use the sound protection box.

## sonotrodes

The sonotrodes are the tools that transmit the ultrasound into the liquid. The selection of the sonotrodes depends on the sample volume and on the required ultrasound intensity. Thin-bodied sonotrodes achieve very high amplitudes up to 250µm, that result in very high ultrasound power densities under the oscillating end surface. A small but very intensive cavitation zone is generated. The bigger the diameter, the higher is the ultrasound power, that is transmitted via the consequently bigger end face of the sonotrode. The ultrasound power density i.e. the ratio between power and oscillating surface becomes smaller. The cavitation zone becomes larger but less intensive. A titanium alloy has proven to be the best sonotrode material as it allows very high amplitudes and as it is resistant to most liquids. Therefore this titanium alloy is the standard material for our sonotrodes and the ultrasonic processors are adjusted to it. For special application cases we manufacture

sonotrodes made of stainless steel, glass or ceramics. The max. amplitudes of the sonotrodes made of these materials are significantly below those of the titanium sonotrodes.

The lengths of the sonotrodes are determined by  $\lambda/2$ . If the ultrasonic processor has the frequency of 24kHz, the titanium sonotrode has approx. the length 100mm but can also be manufactured in manifold lengths. Sonotrodes with O-rings or oscillating-free flanges are used for the input of ultrasound in flow cells or in closed or pressurized systems.

The cavitation, that takes place at the sonotrode surface, results in an abrasional effect. At the max. amplitude, approx. 1mm of the sonotrode abrades within 1000 hours of operation in water. The frequency scanning system of our ultrasonic processors raises then automatically the frequency, so that an abrasion of up to 5mm of the sonotrode does not result in a considerable loss of power.



sample volume (ml)	UP50H	UP100H	UP200H	UP200S	UP400S
0.01 - 0.50	0.5	0.5			
0.1 - 5.0	1	1	1	1	
2 - 50	2	2	2	2	
5 - 100	3	3	3	3	3
10 - 250	7	7	7	7	7
20 - 500		10			
50 - 1000			14	14	14
100 - 2000					22

Approximated values for the selection of the ultrasonic processors and the sonotrode diameters according to sample size.

## flow cells for continuous operation



stainless steel flow cell D7K with MS7D



glass flow cell for UP100H

For our ultrasonic processors we offer flow cells made of glass or stainless steel. The liquid to be sonicated is led in from below and passes through the cavitation zone under the sonotrode. The appropriate sonotrodes are equipped with O-rings, that are fitted closely to the cell wall or the PTFE-adaptor. For higher pressures and temperatures the sonotrodes may be equipped with metallic oscillating-free flanges that are mounted to the stainless steel flow cells. The selected flow rate corresponds to the energy input required. The temperature of the medium can be influenced by means of a cooling jacket. Special designs of the flow cell, e.g. several supply connectors when emulsifying, are manufactured according to the demands of the customer. A new product in our product range is the mini flow cell (patent pending). When using this mini cell, the medium is hermetically sealed, so that the sonication can be realized without contamination.



contamination free flow cell Dmini

## PC-control

As an option, our ultrasonic processors can be equipped or retrofitted with a PC-control package.

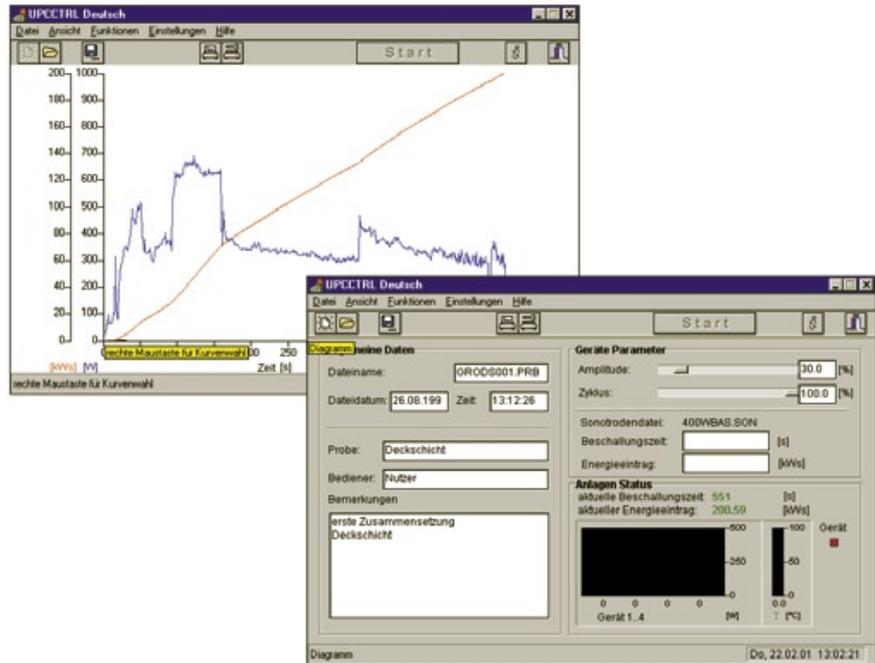
This PC-control gives automation of the process parameters, such as amplitude, pulse, operating time or alternatively the actual energy input. It serves for the monitoring and recording of those parameters, too.

You can display the following features in a time based table or diagram.

- gross ultrasonic power,
- effective ultrasonic power, that is transmitted into the liquid medium,
- effective energy input, and
- temperature (optional).

The PC-control is connected to a laptop or a PC (MS Windows®) using the serial or USB interface.

The PC-control serves as an efficient support in optimizing processes and in creating a compulsory test record.



## survey of all accessories

ultrasonic processor	UP50H	UP100H	UP200H	UP200S	UP400S	UIS250v
power (W)/frequency (kHz)	50/30	100/30	200/24	200/24	400/24	250/24
sonotrode, diameter (mm)						
- titanium	0.5 - 7	0.5 - 10	1 - 40	1 - 40	3 - 40	3 - 10
flow cell						
- glass	GD7K	GD7K	GD14K	GD14K	GD22K	
flow rate (l/h)	1 - 5	1 - 5	5 - 25	5 - 25	10 - 50	
- stainless steel	D7K	D7K	D14K	D14K	D22K	
flow rate (l/h)	1 - 5	1 - 5	5 - 25	5 - 25	10 - 50	
standard flask neck adapter	NSA1	NSA1	NSA2	NSA2	NSA3	
sonication beaker			BB1	BB1	BB1	
fixture for stand	STH-16	STH-16				ST1-Clamp
stand	ST1-16	ST1-16	ST1-16	ST1-16	ST1-16	ST1-16
sound protection box	SB2-16	SB2-16	SB3-16	SB1-16	SB1-16	special
timer	T1	T1	T1	T1	T1	T1
PC-control	UPC-Lab or UPCT-Lab (with temperature sensor)					

Please inform us on your planned application cases. We would be pleased to submit you a matching quotation. Should our basis product range not meet your demands exactly, we will

develop a customized solution according to your requirements. Please use the possibility to rent one of our standard devices.

## our product and application spectrum



sonication of closed vials



ultrasonic laboratory processors



ultrasonic industry processors



ultrasonic sieving in the laboratory



industrial ultrasonic sieving



cutting and welding



ultrasonic dispersing systems



wire-, tape- and profile cleaning



intensive cleaning

Please visit our website at [www.hielscher.com](http://www.hielscher.com), ask for the respective information or contact us. We will be pleased to advise you.



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