

## ***SONOPULS***

### Ultrasonic homogenisers



Ultrasonic homogeniser HD 4100

Valid for:

HD 4050	Volume:	0.5 ml - 100 ml
HD 4100	Volume:	2 ml - 200 ml
HD 4200	Volume:	5 ml - 1000 ml
HD 4400	Volume:	100 ml - 3000 ml

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# General

The equipment, the accessories and the preparations are to be used in accordance with the user instructions and/or the product information.

The instructions are part of the scope of delivery and should be stored in the vicinity of the device for later reference. This also applies if possession of the device is transferred elsewhere.











Before the device is put into operation, these Instructions for Use should be read carefully and completely in order for the user to become familiarised with all functions.

The warnings and safety precautions (chapter 1.5) must always be heeded during use.

The manufacturer will not assume any responsibility for the device's safety or functional ability in the event of improper handling or usage contrary to the intended purpose. In the event of unauthorised alterations/modifications, both the warranty claim and the CE conformity will no longer be valid.

If Service is required, please contact the specialist dealer in charge or the manufacturer.

## Symbols used:

Symbol	Significance	Explanation
	Danger	Identifies information that could signify a risk to life and limb, especially through electric shock, if not observed.
	Caution	Identifies information that is to be observed and adhered to without fail in order to prevent damage to the device and the user. When device parts are labelled with this symbol, reference must be made to the documentation.
	Warning	Warning of hot surface.
	Important	Identifies information that is important for execution.
	Note	Identifies information provided for explanatory purposes.
	In vitro diagnostics information	Identifies information that is important for in vitro diagnostics applications.
	Medical note	Identifies information that is important for medical use.
	Do not grip inside	For health reasons, touching the oscillating fluid is prohibited.
	Wear ear protectors	For health reasons, standing for long periods of time in the vicinity of the device without ear protectors is prohibited.
	Handling instructions	Identifies instructions that must be followed in the described sequence.

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## Informative appendices

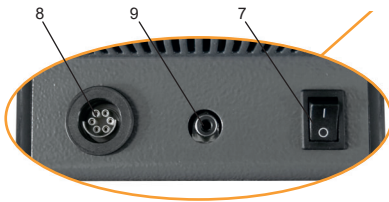
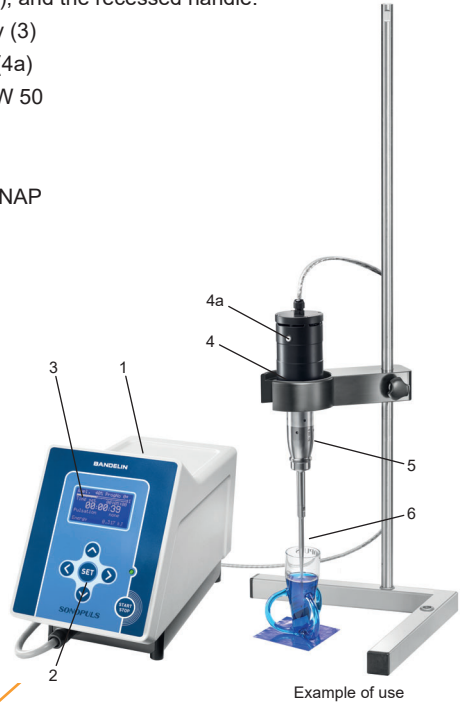
- A Tools for mounting/dismounting

# 1 Product description

The SONOPULS ultrasonic homogeniser is essentially made up of three components: the ultrasonic generator, the ultrasonic converter, and the working tip (probe). The individual components can be varied using a multitude of options and accessories. The type specification and serial number are found on the type plate.

## Product features:

- Ultrasonic generator (1) in low-maintenance, robust plastic housing, with connections for the ultrasonic converter, the temperature sensor (2), and the recessed handle.
- Operating and display panel (2) with LC display (3)
- Ultrasonic converter (4) with Start/Stop button (4a)
- Standard/booster horn (5), not included with UW 50
- Probe (6)
- Mains switch (7)
- Connection (8) for ultrasonic converter - MINISNAP
- Connection for temperature sensor (9)



## Rear side of the ultrasonic generator:

- Mains socket (10) with fuse holder
- Remote control connector(11)
- RS 232 interface (12)



## 1.1 Mode of operation

The ultrasonic generator transforms the absorbed mains energy (mains frequency 50 or 60 Hz) into high-frequency energy with a frequency of 20 kHz. Thanks to the ultrasonic converter that is connected to the ultrasonic generator, the high-frequency energy of the ultrasonic generator is converted into ultrasound and thus into mechanical energy. This takes place with an efficient and robust PZT ultrasonic oscillating system. Thus, mechanical deflections with a similar frequency of 20 kHz, which are transferred into the sonication medium as ultrasound waves with a high power intensity, are generated on the tip of the probe. The amplitude is held constant by the ultrasonic converter (AMPLICHRON® system), independently from the applied load, using a signal feedback as long as the maximum power allowed is not exceeded. Thanks to these measures, the reproducibility of the process parameters is guaranteed and validation of the process is supported.

Standard/booster horns with probes are mounted on the ultrasonic converter. These work as mechanical transformers and enable a multiple mechanical amplification of the ultrasonic amplitude at the tip.

## 1.2 Purpose

SONOPULS ultrasonic homogenisers generate high-performance ultrasound with high intensities and ultrasonic amplitudes, which are transferred into liquid media using working tools called probes. They are used in laboratories, clinics, and in industrial research, and they perform diverse tasks during sample preparation in Quality Assurance, scientific experiments, analyses, and in pilot or short-series manufacture.

### Application examples:

- Cell disruption for paternity tests
- Cell disruption (extraction of microorganisms, tissue cells)
- Homogenising of liquids
- Emulsifying hard-to-mix liquids
- Dispersion of agglomerates
- Acceleration of chemical reactions
- Degassing of fluids
- Sample preparation in environmental analytics (wastewater tests, soil samples)
- Sonochemistry

## 1.3 CE conformity

**IVD**

SONOPULS ultrasonic homogenisers are declared as IVD products and satisfy the CE marking criteria for the European Union:

- IVD directive
- Low-voltage directive
- Electromagnetic compatibility directive
- RoHS - directive

in their currently valid versions.

A declaration of conformity can be requested from the manufacturer by providing the serial number.

## 1.4 Technical data

SONOPULS ultrasonic homogenisers are interference-free and marked with a CE.

Safety: EN 61010-1,

EMC: EN 61326-1

### 1.4.1 Ultrasonic generator (GM)

Mains supply:	230 V~ (± 10 %) 50/60 Hz, alternatively 115 V~ (± 10 %) 50/60 Hz, cable length 2 m
Protection class:	I
Ultrasonic frequency:	20 kHz ± 500 Hz
Frequency control <sup>1/</sup> :	Automatic, resonance frequency search
Time setting range:	0:00:01 – 9:59:59 [h:mm:ss] or continuous operation
Ultrasound operating mode:	Pulsating or continuous
Pulsation time ON ( $t_{E}$ ):	0.2 - 600 s - (see chapter 3.2.2)
Pulsation time OFF ( $t_{A}$ ):	0.3 - 600 s - (see chapter 3.2.2)
Ultrasound control:	Amplitude or power - (see chapter 3.2.4)
Amplitude setting range:	10 - 100 % in 1 % steps
Amplitude display / power display:	Presetting and progress bars
Energy display:	kJ
Temperature sensor:	optional (TM 50 or TM 100)
Temperature display:	-10 – 120 °C
Program storage locations:	9
Operating elements:	Membrane key
Operating data display:	LCD graphic display, illuminated
Remote control (turning on/off):	Button on the ultrasonic converter, potential-free contact, foot switch TS 8 (optional)
Interface:	RS 232
Degree of protection:	IP 30 according to DIN EN 60529

#### Device-specific:

Generator	GM 4200	GM 4400
Power <sup>2/</sup> , maximum	50/100/200 W <sup>3/</sup>	200/400 W <sup>3/</sup>
Ultrasonic frequency	20 kHz	
Power setting range	30 - 150 W	60 - 300 W
Weight (approx.)	3.2 kg	3.6 kg
Exterior dimensions (l × w × h)	335 × 150 × 230 mm	

#### <sup>1/</sup> Frequency control:

The ultrasonic generator has an automatic search feature for resonance frequency and rate adaptation while in operation. Causes for a change in the resonance frequency are, for example, a warming of the ultrasonic converter and the probes, a change in the acoustic load due to changes in viscosity, and even the mounting of another probe. A frequency drift during operation is corrected by the automatic frequency control. The optimum working frequency is sought using the resonance frequency search, e.g. after a change in probe.

#### <sup>2/</sup> Power:

In the case of amplitude control, the ultrasonic power that is needed for the desired probe amplitude is dependent on the viscosity of the medium. In order to prevent damage to the ultrasonic generator and converter, the power is limited to the maximum-allowed peak value. In the case of highly viscous media, this can also result in the desired amplitude not always being reached.

#### <sup>3/</sup> depending on the connected ultrasonic converter



## 1.4.2 Technical data, ultrasonic converters

	UW 50	UW 100	UW 200	UW 400
PZT ultrasonic oscillating system:	✓	✓	✓	✓
Start/Stop key:	✓	✓	✓	✓
Suitable for continuous operation:	✓	✓	✓	✓
Frequency:	20 kHz	20 kHz	20 kHz	20 kHz
Weight:	0.6 kg	1.5 kg	1.6 kg	1.7 kg
Dimensions:	dia. 50 × 190 mm	dia. 70 × 170 mm	dia. 70 × 170 mm	dia. 90 × 180 mm
Degree of protection:	IP 20	IP 20	IP 20	IP 20

## 1.4.3 Further data

### environmental conditions pursuant to EN 61 010-1

Overvoltage category:	II
Degree of contamination:	2
Permissible relative humidity up to 31 °C:	80 %
Permissible relative humidity up to 40 °C:	50 %
Permissible ambient temperature:	5 to 40 °C
Altitude:	up to 2000 m above sea level
No condensation allowed.	
Only for indoor operation.	

### **IVD** Specifications for use as a medical device

Name:	Ultrasonic homogeniser
UMDNS nomenclature (ECRI / DIMDI):	17-125
Purpose:	see chapter 1.2
Medical device pursuant to Directive 98/79/EC for in-vitro diagnostic medical devices:	other IVD
Type, model, serial number, year of manufacture:	See type plate on the generator for information

The homogeniser has been inspected pursuant to norms currently in effect and must be installed and put into operation pursuant to EMC directions; information in this regard is found in chapter 1.4.4

### e-procurement

e-cl@ss:	
HD device classification:	32-08-02-02
HD accessories classification:	32-08-92-05

## 1.4.4 Electromagnetic ambient conditions (EMC)

The device was tested to DIN EN 61326-1 for electromagnetic compatibility (EMC) and complies with the requirements for class B devices according to EN 55011.

It is suitable for use in facilities and areas which are directly connected to a public low-voltage supply network, e.g. medical laboratory facilities.

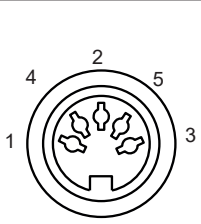
## 1.4.5 Remote operation

Several options are available for remote control and remote operation. Depending on requirements, the most convenient solution may be selected.

	Operating element	Methods	Functions	Connection
1	Key	manual	Ultrasound operation ON/OFF	Fixed on the ultrasonic converter
2	Foot switch	foot-operated	Ultrasound operation ON/OFF	Remote control connector
3	External	control signal	<ul style="list-style-type: none"> <li>Ultrasound operation ON/OFF</li> <li>Status confirmation</li> </ul>	Remote control connector
4	External	data protocol	<ul style="list-style-type: none"> <li>Status inquiry</li> <li>Full device control</li> </ul>	RS 232 interface

### a) Remote control connector

Contact assignment and functional description of the remote control connector

Diagram	Contact	Assignment	Signal	Function
	1	Input	0V L 5V H	L → ultrasound operation ON H → ultrasound operation OFF
	2	Output	0V L 5V H	L → ultrasound operation OFF H → ultrasound operation ON
	3	Earth		
	4	Output		like contact 2
	5	not assigned		



### Notes:

- The connection of power or voltage sources of any type is not permitted.
- The source resistance for the outputs is of 3.3 kΩ. The input resistance for subsequent signal inputs, e.g. optocouplers, must be greater than or equal to 47 kΩ.
- The function of the signal input (contact 1) depends on the mode of operation that is set for the pulsation (see chapter 3.2.2). With the operating mode "by hand key", control is conducted statically, i.e. the ultrasound operation is always activated under L status, and deactivated under H status.

With all other modes of operation, the input works as an edge-controlled changeover switch. The input resistance measures approx. 50 kΩ.

- When connecting a changeover contact (toggle function) to connector 1, the make time must be  $> 100$  ms.

**b) RS 232 interface connection**

The RS 232 interface connection is located on the rear side of the ultrasonic generator.

For connection and communication purposes, a standard serial conductor (RS 232) can be used. Implementation of the technical programs required for communication is the responsibility of the operator and is not supported by the manufacturer. The manufacturer only guarantees the proper functioning of the interface.

The instruction set for the RS-232 interface will be made available by the manufacturer free of charge, upon request.



**Important:**

Proper operation will depend on the length of the connection cable. If an extension is used, a length of 5 m may not be exceeded.



**Caution:**



The inputs and outputs of the remote control connector and RS-232 interface may only be connected with devices of protection class I that are connected to the same mains supply circuit.

## 1.5 Warnings and safety precautions

### General

- Keep the device and accessories out of the reach of children and also of persons who have not been instructed in their operation by reference to these instructions.
- The use of the device or parts thereof on humans or animals is not authorised.
- Keep the ultrasonic generator and operating elements clean and dry.
- Do not expose the unit to corroding forces.
- When working with the device, please observe hygiene instructions pursuant to chapter 5.2.
- The connection of any type of power or voltage sources to the signal inputs or outputs is forbidden.
- Signal lines from foot switches, temperature sensors, etc., may not exceed a maximum length of 3 m.
- All plug connections (such as for ultrasonic converters, foot switches) may only be plugged or unplugged while the device is turned off or in idle mode (pause mode).
- The ultrasonic generator and ultrasonic converter must be transported separately.
- Ultrasonic homogenisers adhere to prescribed EMC limit values, so that it can be assumed that the electromagnetic radiation emanating from the units is harmless to humans. A binding statement for wearers of implants can only be made at the place of work and together with the implant manufacturer. In case of doubt, information regarding the allowable electromagnetic exposure level should be obtained from the implant manufacturer.

### Operation

- Observe ambient and set-up conditions, see chapter 1.4.
- Determine the mains voltage before connecting the ultrasonic generator.
- Only connect the ultrasonic generator to a grounded socket.  
Fuse protection 16 A (main circuit breaker).
- Firmly mount the ultrasonic converter on the black housing only, using a suitable support.
- Before each start-up, check that the probe is firmly positioned on the standard or booster horn; if necessary, tighten the probe (see chapter 4.3.1).
- Do not touch any oscillating parts (e.g. standard or booster horns, micro tips or tapered tips, titanium flat tips, ultrasonic converter) during operation! Damage to health is possible.
- Do not touch the sonication vessels with the oscillating probe - probes and vessels could be damaged.
- The sonication of liquids generates noise. Suitable accessories, such as a sound proof box, will minimise such noise considerably. If operating without a sound proof box, wear hearing protection.
-  Warning, risk of splashing!  
This is especially the case with small sample quantities and when immersing oscillating probes.
-  Do not use combustible solvents in open reaction vessels since the operating safety of the homogeniser could be compromised. Safe extraction of combustible vapours must be guaranteed. When using a sound proof box, the vapours cannot escape.
- Before any mounting or dismounting (chapters 4.3 and 4.4) of probes, standard/booster horns or accessories, turn off the device and disconnect the ultrasonic converter from the ultrasonic generator.
- Only use the prescribed tool for mounting and dismounting (see appendix A).
- Do not use any bent probes ( $\Rightarrow$  unstable operation, loss of power).



- Liquids must not penetrate the inside of the ultrasonic converter or ultrasonic generator.
- Never twist the ultrasonic converter's housing toward the aluminium cylinder (ultrasonic oscillating system). The ultrasonic oscillating system and its electrical connections would be damaged as a result.
- Do not operate the device without supervision.

#### **IVD** Advice for the medical and laboratory field

- The homogeniser is exclusively intended for use by skilled personnel.
- In isolated cases, unfavourable operating conditions may result in EMC disruptions that may affect devices that are in the direct vicinity.
- During operation, portable or mobile HF communication systems in the vicinity of the homogeniser should be turned off - operation may be disrupted.

#### **Damages**

- If damage to the homogeniser is detected, do not connect the ultrasonic homogeniser to the mains.
- In the event of defects, disconnect the power plug immediately.
- Repairs must only be conducted by authorised skilled personnel or by the manufacturer.
- Defective parts must only be replaced with original parts or parts of the same quality!

## **2 Preparation**

Carefully unpack the ultrasonic generator, ultrasonic converter and accessories, and inspect them for completeness or possible transportation damage. If any damage or defects are found, these must be immediately notified in writing to the transportation company and to the supplier. Before startup, the ultrasonic homogeniser is to be left to stand at its operating location for 2 hours so that it may adapt to the ambient conditions.

## 2.1 Scope of delivery

The scope of delivery will depend on the size of the order. However, it will generally include the following parts:

- 1 Ultrasonic generator GM .... - see delivery note
- 1 Ultrasonic converter UW ...
- 1 Standard/booster horn SH ...
- 1 Probe
- 1 Tool set
- 1 Instructions for Use manual

Additional accessories according to order – see delivery note

## 2.2 Set-up / assembly



- Place the ultrasonic generator atop a firm, level and dry surface. In doing so,
  - do not group it or stack it over other electrical or electronic devices,
  - do not cover the ventilation holes on the ultrasonic converter's housing,
  - guard against moisture and wetness - risk of electric shock.
- The ultrasonic generator must be positioned in such a way that disconnection from the power supply is easily possible.
- During delivery, the standard/booster horn (if required) is already firmly screwed to the corresponding ultrasonic converter.  
Other standard/booster horns are mountable. To do so, see instructions in chapter 4.4.
- Screw the delivered probe to the standard/booster horn, see chapter 4.3.1.
- Position the ultrasonic converter safely and correctly inside a suitable holder.  
To do so, affix the ultrasonic converter on the black housing alone.
- Position the ultrasonic converter with holder in a sound proof box.
- The ultrasonic converter is connected to the ultrasonic generator through a push-pull circular connector with lock (MINISNAP). To connect, hold the connector from the handle and position it in such a way that the arrow points to the left. The connector can only be plugged in when in this position. Plug the connector into the socket up to the limit, until it snaps in place. In order to unplug the connection, hold the connector only from the handle, pull it back and remove the connector. If necessary, see chapter 1.
- Verify that the mains switch is in the "0" position.
- Before the mains connection, identify the mains voltage at hand and compare it with the voltage specified on the type plate on the generator bottom. Connect to a grounded socket only if type is suitable.

## 2.3 Start-up

- Check the positioning of the ultrasonic converter in the holder.
- Check the firm positioning of the probe and, if needed, clean thoroughly.
- Connect the ultrasonic generator to the mains (grounded socket) and switch on.
- Set the probe type (see chapter 3.1.1.)
- Conduct a function test in accordance with chapter 6.2.1 if necessary (e.g. after replacing the ultrasonic converter).
- Connect the temperature sensor (if needed).

## 3 Operation

### 3.1 Operating elements

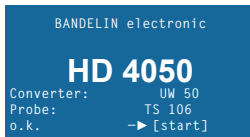
Operation is conducted from the operating and display panel on the front side of the ultrasonic generator:



1	LC display	Display of the operating parameters and status information
2	"START/STOP" key	Starting or stopping the ultrasound emission, ending functions, exiting the menu
3	"SET" key	Call-up of the menu. Navigation within the menu
4	"Arrow" keys	Setting the menu or operating parameters
5	Control LED	green light: Ultrasound output blinking green: Remote control through the RS 232 interface or red light: Error messages blinking red: Warning messages

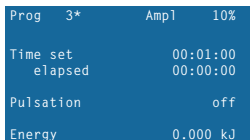
### 3.1.1 Turning the homogeniser on/off

The homogeniser is turned on with the power switch (front side, bottom). After turning on, the LC display must light up. Initialisation occurs automatically. The ultrasonic homogeniser will display the manufacturer's name, type designation, and the last-connected probe. The type designation depends on the ultrasonic converter that is connected



UW 50 → HD 4050  
UW 100 → HD 4100  
UW 200 → HD 4200  
UW 400 → HD 4400

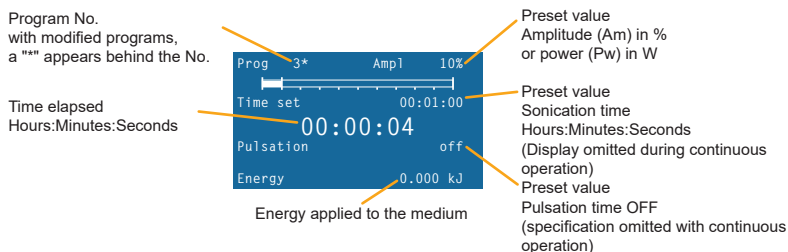
If the probe type displayed does not conform with the probe that is mounted, the correct probe type will have to be set using the arrow keys  $\wedge$  or  $\vee$ , before the next steps. By pressing the "START/STOP" key, the menu switches into stand-by mode (idle mode) and the ultrasonic homogeniser is ready for operation. The parameters used during the last operation will be set again and displayed. If the ultrasonic converter was exchanged in the meantime, the earlier settings will be replaced by standard values and must be re-edited. The temperature display is only visible when a temperature sensor is connected.



The mains switch can also be used for powering off.

The powering-off process may take a few seconds while the current data is saved internally. The monitor is turned off during this process. When powered-on again, the data becomes available once again.

### 3.1.2 Explanation of the display fields



### 3.2 Setting the operating parameters

With the exception of the amplitude and power, the operating parameters can only be set while in stand-by mode (idle mode). In order to set or edit the parameters, the desired field can be selected by pressing the "SET" key. The respective function can then be selected using the arrow keys  $\wedge$   $\vee$ . If the parameter has number values that can be edited, the editing mode is then activated with the arrow key  $\triangleright$ . In the marked area (inverse view) of the parameter, the desired value can be



set with the arrow keys  $\wedge$   $\vee$ . It is possible to move between individual setting fields within the parameter using the arrow key  $\leftarrow$ . Editing mode is cancelled with the "SET" or "START" keys.

The following operating parameters can be set:

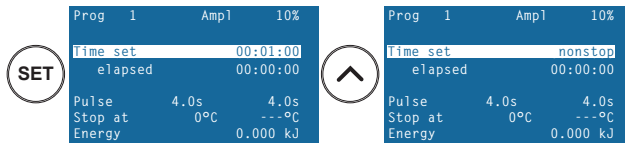
- Default values for the relative amplitude or power ([Ampl [%] or Power [W])
- Default values for the sonication time (Time set [hh:mm:ss])
- Default values for the pulsation of the ultrasound (turn-on and turn-off time) (pulse [s])
- Limit value for the temperature monitoring [ $^{\circ}$ C]

The operating parameters "Energy" and "Elapsed sonication time" cannot be edited.

### 3.2.1 Sonication time [Time set]

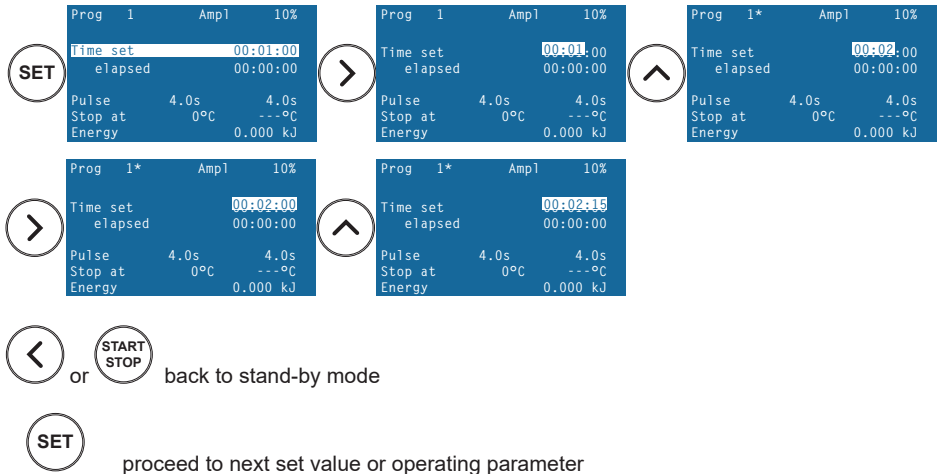
A value of 9 hours, 59 minutes and 59 seconds (9:59:59) is the maximum sonication time that can be set. If the set value is exceeded during ultrasound operation, the sonication will stop. The parameter "non-stop" is equivalent to unlimited continuous operation until ultrasound operation is ended by pressing the "START/STOP" key.

#### a) Setting continuous operation [non-stop]



#### b) Setting the sonication time

If a value of 59 minutes or seconds is exceeded when setting the time, or if a shortfall occurs when setting back the time, the values for the set hours or minutes will change accordingly. Example:



### 3.2.2 Pulsation [Pulsation]<sup>1/4</sup>

In addition to setting the pulse turn-on time  $t_E$  and the pulse turn-off time  $t_A$ , two additional operating modes can also be set:

- off                      no pulsation or continuous sound
  - by hand key        it is possible to pulse manually with the key on the ultrasonic converter.
- Ultrasound operation will be active as long as the key on the ultrasonic converter is pressed.

#### a) Setting the operating modes

The diagram illustrates the process of setting the pulsation mode. It begins with a 'SET' button. The first screen shows 'Pulsation' set to 'off'. Pressing the up arrow leads to the second screen where 'Pulsation' is set to 'by handkey'. Pressing the down arrow leads to the third screen where 'Pulsation' is set to '4.0s'.

#### b) Setting the time intervals

The maximum setting value is 600.0 s. The minimum setting value will depend on the type of device and ranges between 0.1 and 0.3 s.

The screenshot shows the device display with 'Pulsation' set to 4.0s. Other parameters include 'Time set' (00:02:15), 'elapsed' (00:00:00), 'Stop at' (0°C), and 'Energy' (0.000 kJ).

Turn-on time  $t_E$

The diagram shows the process of setting the turn-on time  $t_E$ . It starts with a right arrow button. The first screen shows 'Pulse' set to 4.0s. Pressing the up arrow leads to the second screen where 'Pulse' is set to 5.1s.

Turn-off time  $t_A$

The diagram shows the process of setting the turn-off time  $t_A$ . It starts with a right arrow button. The first screen shows 'Pulse' set to 5.1s. Pressing the down arrow leads to the second screen where 'Pulse' is set to 4.0s.



back to stand-by mode



proceed to next operating parameter

<sup>1/4</sup> The pulse period duration is the sum of the turn-on and turn-off time  $t = t_E + t_A$

### 3.2.3 Temperature monitoring [Temperature]

The temperature in the sonicating medium can be monitored using the temperature sensor. The following functions can be set:

- off no monitoring
- stop if the temperature falls below the limit value once again, the ultrasound operation will be turned off. If the temperature falls below the short of the limit value once again, the ultrasound operation will not automatically continue.
- alarm when reaching or exceeding the set temperature limit value, an acoustic and visual warning signal (red blinking LED) will be triggered. The ultrasound operation will not be turned off.

#### a) Setting the type of monitoring

Example:

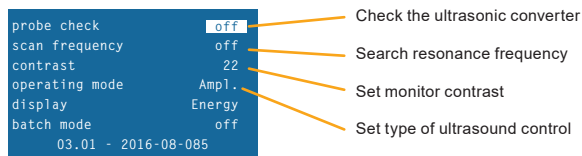
The maximum setting value is 120 °C, the minimum is -10 °C.

As shown in the example, the values for the Alarm and Stop functions are carried over when defining a limit temperature. An Alarm is triggered simultaneously in Stop mode.

Temperature measured at temperature sensor  
No sensor: ---°C

### 3.2.4 Miscellaneous functions and settings

Additional functions are available within a second menu level. These can be accessed by simultaneously pressing and holding the "SET" key and  $\blacktriangleright$  arrow key. Switching between these functions is accomplished with the "SET" key in the manner already described. The menu level can only be exited by pressing the "START/STOP" key. In doing so, settings and function statuses are carried over and executed.



#### Check the ultrasonic converter [probe check]

This function is used for quick verification of whether the ultrasonic converter is recognised by and can be correctly activated by the ultrasonic generator. After a change in probe or in operating conditions it is possible, for example, that the ultrasonic generator cannot synchronise with the ultrasonic converter and issues an error message, e.g. Error 011. The frequency is reset to the base value and the function is restored if no device fault or other cause is present.

The set value is "off". In order to activate the function, set the parameter to "start" using the arrow keys  $\blacktriangle$   $\blacktriangledown$ , and then press the "START/STOP" key. See chapter 6.2.1 for additional information.

#### Search for resonance frequency [scan frequency]

This function is an expansion of the above-mentioned "probe check" function. In addition, a frequency scan is conducted in order to determine the correct ultrasonic frequency for the ultrasonic converter. Depending upon the probe used and the operating conditions, the frequency can fluctuate significantly in some instances. When switched off, the ultrasonic generator saves the current frequency value and uses it as the start value when switched on again. If there are significant deviations in the current frequency, this can lead to malfunctions.

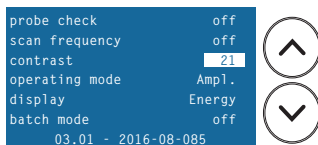


#### Important:

After a successful scan while in continuous operation (pulsation = off, time > 30 s), start with an amplitude setting of 50 % and check the operation. Next, set the desired value.

#### Setting the monitor contrast [contrast]

With this function, the monitor contrast can be adapted to the local light conditions. The contrast values range between 1 and 68, and can be set with the arrow keys  $\blacktriangle$   $\blacktriangledown$ . Smaller values result in a darker image and larger values result in a lighter image. The default value is 22.



## Type of ultrasonic regulation [operating mode]

Here you can define whether the ultrasonic homogeniser should work with amplitude or power control.

Ampl. → Amplitude control = constant amplitude

Thanks to the direct data logging in the ultrasonic converter (AMPLICHRON® system), the amplitude is precisely and quickly measured and set. In the process, the power output may fluctuate based on the physical state of the medium.

Power → power control = constant power output

The control variable is calculated based on the measured electrical power, and has a process-dependent time delay. Faster fluctuations are balanced only on average. Depending on the physical state of the medium, the amplitude may fluctuate. This type of regulation cannot be recommended for reproducible results.

## Change display [display]

Here it can be chosen whether the accumulated energy (Energy) or the current ultrasonic frequency (frequency) is displayed.

## Sequencing [batch mode]

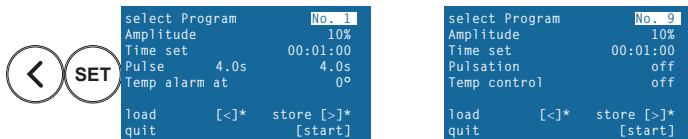
With this function (batch mode: on), there is an option for processing previously grouped sonication programs. The configuration of a sonication program is described in chapter 3.3 and the activation is described in chapter 3.4.

## 3.3 Loading / saving sonication programs

The ultrasonic homogeniser possesses a working memory and 9 memory locations for sonication programs.

In order to work with a sonication program, it must first be loaded into the working memory. If changes in the operating parameters are made in the working memory, a \* (asterisk) will appear after the program number [Prog]. If these changes need to be available later as samples, the current operating parameters may be saved on one of the 9 memory locations.

Memory management is called up with the keys "SET" and the arrow key ←.



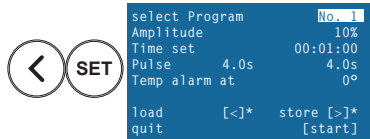
By pressing the "SET" key, the content of the working memory (current program) can be displayed for comparison purposes, e.g. to facilitate the selection of a memory location. The desired memory location to save or load a sonication program can be detected by using the arrow keys  $\wedge$  and  $\vee$ .

### Loading the sonication program

In order to copy the content of the selected program memory in the working memory, the arrow key  $\leftarrow$  is pressed and held until an audible signal is emitted. The data can be used after leaving the program administration.

### Saving the sonication program

By continuously pressing the arrow key  $\rightarrow$  until an audible signal is emitted, the content of the working memory is transferred into the selected program memory. Then, the new contents are displayed.

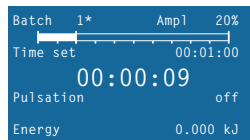


The "START/STOP" key is used to exit memory management and return to stand-by mode.

## 3.4 Batch operation (batch processing)

Simple sonication profiles can be compiled and facilitated through the automated step by step processing of stored sonication programs.

Intend sonication programs for batch processing can be selected with the arrow keys  $\wedge$  and  $\vee$ . With the arrow key  $\rightarrow$  the memory location is marked with "B" for batch processing and with  $\leftarrow$  unmarked again. In this case simple sonication profiles can be compiled. The processing always starts up wit the lowest marked program number and is continued wit ascending numbers.



The batch mode must be activated for processing (see chapter 3.2.4). Instead of the actual program (Prog) the corresponding batch program is displayed (inverse representation).

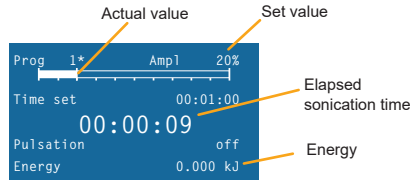


#### Note:

In this operating mode no more changes of settings are possible within the stand-by mode or ultrasonic operation.

### 3.5 Activating / deactivating the ultrasound

Ultrasound operation can be started and stopped by pressing the "START/STOP" key or the key on the ultrasonic converter. Ultrasound operation ends once the target time has elapsed (if a time has been set), and a signal tone (short + short) is emitted. When the device is restarted, the displays for the elapsed sonication time and for the energy are set to zero.



In contrast to stand-by mode, ultrasound operation displays the actually achieved value in bar graph form, in addition to the pre-set amplitude or power.



#### Important:

Depending upon the physical conditions, i.e. the viscosity of the sonicated medium and the thus-resulting control processes, a difference between the target and the actual value, as well as a fluctuating display, may occur.

The amplitude and the power can be changed at any time during ultrasound operation with the arrow keys **▲** and **▼**. All other operating parameters can only be edited while in stand-by mode (see chapter 3.2).



#### Notes:

- If the ultrasound operation is manually interrupted before it reaches the activated target time, the display values for the elapsed sonication time and for the energy will be saved and will continue running upon restart. The display values can be reset to zero by pressing the "SET" key and then pressing the "START/STOP" key.
- With the "non-stop" setting, the elapsed sonication time and energy must also be manually reset, if needed. Once the maximum displayable time has been reached and exceeded, the time display will start again at 0:00:00.
- If the maximum displayable energy value of 99999.99 kJ is exceeded, the display starts again at 0.000 kJ.
- The displayed value for energy is just a reference value and does not correspond to the acoustic energy actually introduced.

## 4 Use

### 4.1 Instructions for use



- Do not touch the sonication vessels with the oscillating probe - probes and vessels could be damaged.
- The recommended immersion depth for probes is of 10 - 20 mm, to prevent the aspiration and mixing-in of air. If mixed-in air is desired, the probe may be immersed just a few millimetres. In the case of greater immersion depths and/or the sonication of liquids with high viscosities, the probe is more heavily damped. As a result, it is possible that the pre-set amplitude may not be reached, especially with higher default settings (>50 %). The reason is that the ultrasonic generator can no longer provide the required power, or the power limit value has been reached (protective function).
- When producing emulsions, the probe should be immersed to the level of the interface between the liquids to be mixed.
- Do not use combustible solvents in open reaction vessels since the operating safety of the homogeniser could be compromised.



- In order to shut down the device, disconnect it from the mains (pull the plug).

### 4.2 General use

Before starting use, the important instructions in chapter 4.1 should be heeded!

#### **Step 1: Check the ultrasonic converter**

- Verify that all connecting cables and couplings are correctly connected.
- The probe type must conform to the sonication volume, see table in chapter 4.3.
- The probe must be clean and correctly mounted (see chapter 4.3.1).
- The ultrasonic converter must be securely affixed.

#### **Step 2: Prepare the sonication**

- Prepare the sonicating medium.
- Position the sonication vessel below the ultrasonic converter in such a manner that the probe does not come in contact with the vessel.
- Set the immersion depth for the probe (approx. 10 -20 mm).
- If needed, connect the temperature sensor and position it in the medium.



### **Step 3: Turn on the homogeniser**

- Turn on the homogeniser with the power switch.
- All saved data and settings will be loaded. Check the settings and load a different program if necessary, see chapter 3.3.

### **Step 4: Activate the ultrasound**

- Select a small amplitude at the start to prevent any splashing. Observe the maximum allowed amplitude, see chapter 4.3.
- Activate the ultrasound



Warning, risk of splashing!

This is especially the case with small sample quantities and when immersing oscillating probes.

### **Step 5: Remove the sample**

After sonication, the probe must be removed from the medium. Leaving them in the sonicating medium for a longer time can cause damage to the probe.

- Once the program or time setting has elapsed, the delivery of ultrasound ends automatically.
- If continuous sonication has been set, the ultrasound delivery must be stopped manually.
- Remove the probe and the temperature sensor, if present, from the sonicating medium.

### **Step 6: Clean the probe**

In order to prevent contamination with other sonicating media, probes are to be thoroughly cleaned after every sonication, see chapter 5.2.

- Turn off the homogeniser with the power switch.
- Clean the probe and check the wear on the sound emitting surface at regular intervals, see chapter 5.1.

## 4.3 Selecting a suitable probe

Detailed information on the individual probes can be found in the separate product information.

### GM 4200 with UW 50

Probe		TS 102	TS 103	TS 104	TS 106	TS 109
Ø Tip	[mm]	2	3	4.5	6	9
Sonicated volume	[ml]	0.5 – 20	1 – 25	3 – 50	5 – 75	10 – 100
Max. amplitude	[ $\mu\text{m}_{\text{SS}}$ ]	125	118	90	70	58
Max. setting	[%]	100	100	100	100	100

### GM 4200 with UW 100 and SH 100 G

Probe		TS 102	TS 103	TS 104	TS 106	TS 109	TS 113	TT 213
Ø Tip	[mm]	2	3	4.5	6	9	12.7	12.7
Sonicated volume	[ml]	2 - 25	3 - 50	5 - 75	10 - 100	15 - 150	20 - 200	20 - 200
Max. amplitude	[ $\mu\text{m}_{\text{SS}}$ ]	260	245	195	155	130	82	80
Max. setting	[%]	90	100	100	100	100	100	100

### GM 4200 with UW 200 and SH 200 G

Probe		TS 103	TS 104	TS 106	TS 109	TS 113	TT 213	TS 216	TS 219	TS 225
Ø Tip	[mm]	3	4,5	6	9	12,7	12,7	16	19	25
Sonicated volume	[ml]	5 - 90	5 - 100	10 - 350	10 - 500	20 - 900	20 - 900	25 - 900	25 - 900	30 - 1000
Max. amplitude	[ $\mu\text{m}_{\text{SS}}$ ]	280	235	220	200	140	105	90	78	60
Max. setting	[%]	65	70	75	80	100	100	100	100	95

### GM 4400 with UW 400 and SH 400 G

Probe		TS 413	TS 416	TS 419	TS 425	TS 432	TT 438
Ø Tip	[mm]	13	16	19	25	32	28
Sonicated volume	[ml]	100 - 750	250 - 1000	250 - 1500	500 - 2000	500 - 2500	500 - 3000
Max. amplitude	[ $\mu\text{m}_{\text{SS}}$ ]	242	196	142	82	59	42
Max. setting	[%]	80	100	100	100	65	50

#### Remark:

After technical updating of the probes, the data may be changed.  
The stored data in the program are always valid!

### 4.3.1 Mounting and dismounting of the probes

Probes

- are screwed onto the standard/booster horns or directly onto the ultrasonic converter,
- transmit ultrasonic power into the medium to be sonicated,
- are made of high-strength titanium alloy.

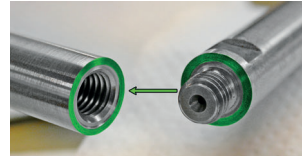


#### Caution !

Probes are sensitive to shock.

Before mounting the probes, the ultrasonic generator must be turned off and the ultrasonic converter must be disconnected from the ultrasonic generator.

The mounting surfaces<sup>/5</sup> must be thoroughly cleaned so that the amplitude and/or power can be transmitted to the medium. If the mounting surfaces are not cleaned, the probe and the standard/booster horn could be ruined as a result.



#### Note

The tool required for mounting/dismounting is included in the scope of supply.

<sup>/5</sup> The mounting surfaces are the contact surfaces between the standard/booster horn and the probe.

### 4.3.1.1 Mounting and dismounting the titanium flat tips

The titanium flat tip TT 213 is mounted on standard/booster horn SH 100 G or SH 200 G.

- First, carefully wipe the mating surfaces of the standard/booster horn and of the titanium flat tip ⇒ ensure clean mating surfaces.
- Screw on the titanium flat tip by hand.
- Apply spanner - SW 10 for TT 213 - to the spanner fitting on the titanium flat tip.
- Firmly hold the standard/booster horn using sickle spanner HS 40/42 and firmly mount the titanium flat tip to the standard/booster horn.
- Dismount in the reverse order.



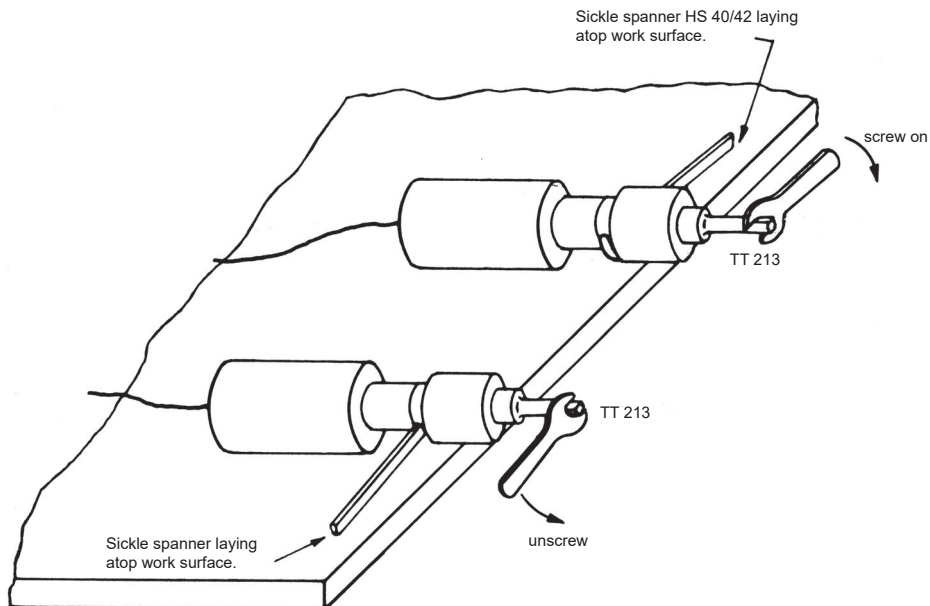
Note: Observe the torque. - see product information

Video available under:

[https://www.youtube.com/watch?v=hjTC\\_cvO4kQ](https://www.youtube.com/watch?v=hjTC_cvO4kQ)



Sickle spanner HS 40/42 laying atop work surface.



### 4.3.1.2 Mounting and dismounting of titanium probes

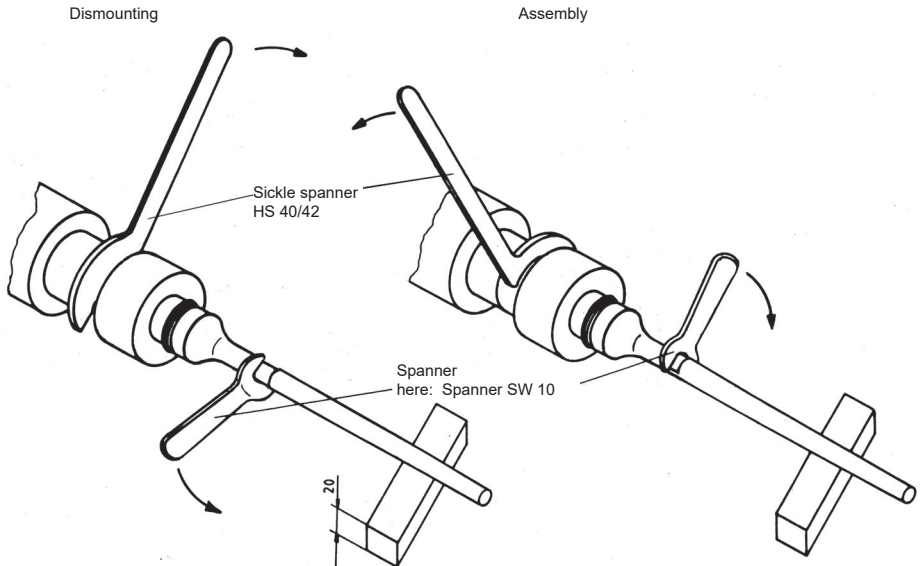
On UW 100/200, titanium probes (TS ...) are mounted onto standard/booster horn SH 100 G/ SH 200 G. On UW 50 they are directly mounted

- First, carefully wipe the mounting surfaces of the standard/booster horn and the probe ⇒ ensure clean mounting surfaces.
- Screw on the probe by hand.
- Lay the probe on an approx. 20 mm thick base so that it does not bend.
- Firmly hold the standard/booster horn in place using sickle spanner HS 40/42, and tighten the probe using the appropriate spanner, see illustration. It is recommended to use the torque wrench DMS 10.



Note: Observe the torque. - see product information

- With the UW 50 use sickle spanner HS 25/28 - the probe is mounted directly onto the UW 50.
- Dismount in the reverse order.



## 4.4 Dismounting and mounting the standard/booster horns

Standard/booster horns

- are screwed onto the respective ultrasonic converter,
- are made of high-strength titanium alloy,
- transmit the oscillations to the probe,
- enhance the amplitude thanks to their geometry.

Standard/booster horn SH 100 G is firmly mounted onto the UW 100 and SH 200 G onto UW 200 at the time of delivery.

Before mounting the standard/booster horns, the ultrasonic generator must be turned off and the ultrasonic converter must be disconnected from the ultrasonic generator.

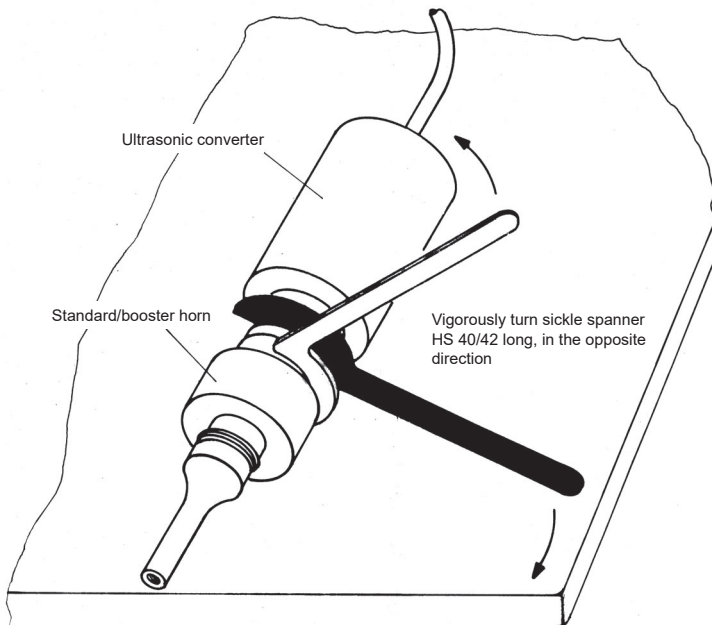
Video available under:

<https://www.youtube.com/watch?v=NXbGc6nAb5c>



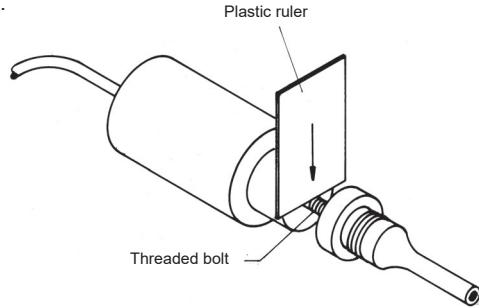
### Dismounting

- Release the firmly-mounted standard/booster horn SH from the ultrasonic converter UW. To do so, lay the ultrasonic converter on a firm base (non-slip if possible).
- Place one sickle spanner on the ultrasonic converter and the other sickle spanner on the standard/booster horn. To dismount, press the first sickle spanner against the firm base, press the other sickle spanner firmly in the opposite direction.
- One sickle spanner is part of the scope of delivery of one standard/booster horn.

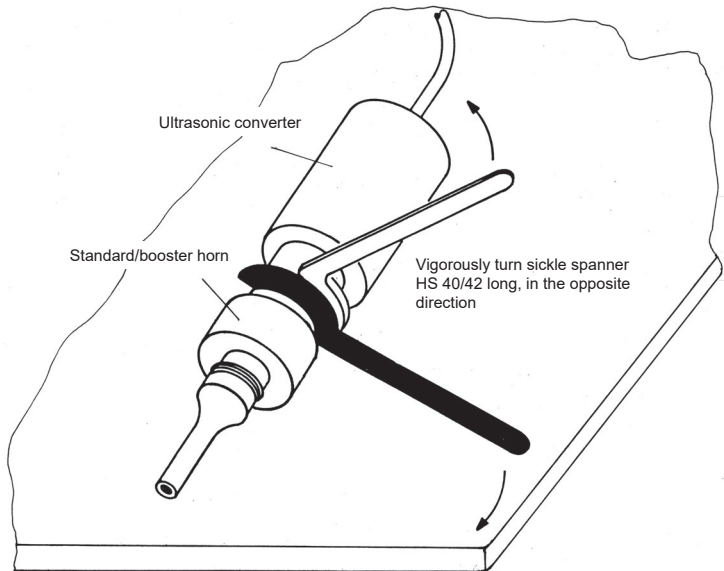


## Assembly

- Keep the mating surfaces/threads to be screwed clean, using alcohol and a fibre-free cloth if needed.
- Screw in approx. 2/3 of the length of the threaded bolts of the new standard/booster horn to be mounted, into the mounting surface of the ultrasonic converter.
- Place a plastic ruler or similar on the threaded portion of the bolt, and press lightly in the direction of the arrow ⇒ this will prevent the bolt from turning any further when the standard/booster horn is screwed on.



- Screw the standard/booster horn onto the threaded bolt and first tighten by hand after removing the ruler.
- Then, mount the standard/booster horn firmly onto the ultrasonic converter using both sickle spanners.



Detailed information on the individual standard/booster horns can be found in the separate product information.



### Caution!

The black housing of the ultrasonic converter and the aluminium cylinder (ultrasonic oscillating system) may not be turned against each other. The ultrasonic oscillating system and its electrical connections would be damaged as a result.

## 5 Cleaning and maintenance of the homogeniser

To achieve an optimum lifespan for the ultrasonic homogeniser, cleaning and maintenance should be conducted regularly.



### CAUTION!

Always disconnect the homogeniser from the mains before performing cleaning/maintenance.



Do not rinse or immerse the homogeniser in water and do not expose it to splash water.

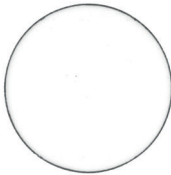
### 5.1 Cleaning and care

#### Probes

All probes are subject to process-related wear, which leads to erosion on the sound-emitting surface and thus to a reduction in power.

In the case of frequent use, it is recommended that an inventory supply of probes be kept.

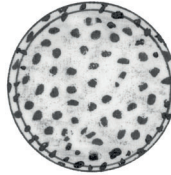
Examples of wear, e.g. on titanium flat tip TT 13:



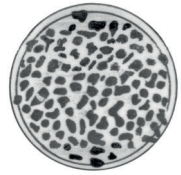
New titanium flat tip



Erosion still permissible, plate can be polished



Start of pitting, milling or grinding necessary



Limit value for erosion exceeded, replacement necessary

The sound-emitting surfaces can be carefully polished or milled a few times. If abrasion of material due to erosion or post-processing exceeds a value of approx. 1 mm, or if there is no power display on the generator, the probe is non-resonant and can no longer be used.

Reconditioning of the sound-emitting surface:

Reconditioning can be performed using a grinding machine with a fine grinding wheel of suitable grain size, or by hand using a diamond file. Suitable grinding materials are, for example:

- Fine abrasive wheel, polyurethane-bound – grain size 150
- Fine abrasive wheel, rubber-bound – grain size 120
- Grinding wheel PNK, corundum – grain size 180 ... 280
- Diamond file, D 181 or D 251

#### Ultrasonic converter/Ultrasonic generator

- Do not use any abrasive cleaners, only commercial care products without abrasive additives.
- Housing is to be wiped off only from the outside, use a suitable surface disinfectant if needed. Afterwards, allow to dry off or wipe dry.



## 5.2 Treatment of contaminated parts in the ultrasonic converter, vessels and accessories pertaining to the medical field



When working with ultrasonic homogenisers, the sonicating parts, vessels and other accessories (e.g. stands, mounting tools) could become contaminated with microorganisms or toxicologic agents and lead e.g. to cross-infections. Disinfection and/or cleaning is required.

In the event of incorrect or irregular disinfection and cleaning, contamination is possible, especially at the connecting points (between probe and standard/booster horn) and at the sound-emitting surfaces (see chapter 5.1, Wear).

Therefore, the sonicating parts (such as the standard/booster horn, probe), vessels and accessories should be disinfected and cleaned after every use, and dismantled for this purpose if necessary.

In the event of toxic contamination, the applicable regulations and provisions of BGR 250/TRBA 250 are especially to be observed.

The disinfection and cleaning should be performed regularly by the operator, if applicable in accordance with the hygiene plan and using a VAH-certified or other effective surface disinfectant.



### **Important:**

Additional information and provisions locally applicable at the user's/operator's site must be observed.

## 5.3 Warehousing / storage

During extended periods without use, the homogeniser should be stored in a cool, dry place. The ultrasonic converter should be covered in order to protect the electronics from outside contamination.

## 6 Maintenance and repair

### 6.1 Maintenance

SONOPULS homogenisers are maintenance-free.

Aside from the process-dependent cavitation erosion on the sound-emitting surface of the probes, no other homogeniser parts are subject to wear. Worn out or faulty probes can be replaced following the instructions in chapters 4.3.1 to 4.4.

The devices are calibrated at the time of delivery. A control of the calibration is only required after repairs, and will only be conducted by the manufacturer.

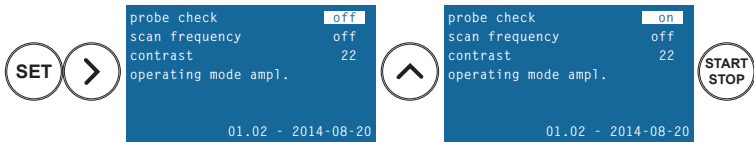
### 6.2 Functional checks

See also chapter 3.2.4 for description and operation.

In case of Error 011 and Error 012, always start testing according to chapter 6.2.1 first.

#### 6.2.1 Testing the ultrasonic converter (probe check) – Error 011

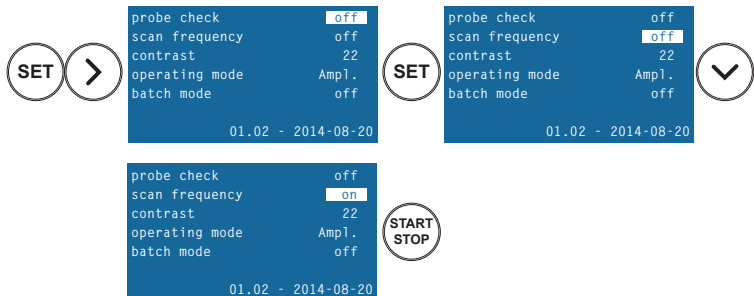
The test is preferably conducted while the probe is acoustically coupled, i.e. the probe should be immersed in the sonicating medium.



The ultrasonic frequency depends on the probe, and the actual value may vary from the example presented here. After successful completion, the monitor display switches back to stand-by mode. Otherwise, an error message appears again.

#### 6.2.2 Conducting a frequency scan (scan frequency) – Error 002/011/012

The conditions for execution are similar to those for conducting checks with the "probe check" function, see chapter 3.2.4.



The frequency scan is completed once fine-tuning has been successful, and the display switches back to stand-by mode.

Otherwise, an error message such as Error 012 appears again.

## 6.3 Error analysis

Errors may arise

- on the plug connections
- on the ultrasonic converter
- on the probes
- on the ultrasonic generator

The device is robustly constructed and designed for a high level of reliability. Nevertheless, the possibility of a malfunction due to a defective component can never be fully discounted. Mechanical defects of the connection for ultrasonic converter, the plug connectors, the ultrasonic converter, etc., are possible as a result of frequent use or even incorrect handling, e.g. by dropping them.

Critical faults are recognised by the device and signalled by a red LED and an intermittent signal tone (3 times), and displayed with an error number, see next page.

Error no.	Possible cause	Remedial action
Converter: No USC	No ultrasonic converter (USC) connected to the ultrasound generator (GM)	Connect the USC to the horn/probe on the GM. The GM should then automatically recognize which USC has been plugged in.
002	Frequency setting not possible	Perform frequency scan. If the error occurs again, contact BANDELIN.
003	No power output, amplitude setting not possible	Error correction should only be carried out by BANDELIN. Send in the complete ultrasonic homogeniser.
004	Mains voltage interrupted	Check mains connection, check fuse
010	Frequency synchronization malfunctioning, frequency display is not currently possible	<ul style="list-style-type: none"> <li>- Check whether the probe has been mounted correctly = sufficiently tight</li> <li>- Check for damage: <ul style="list-style-type: none"> <li>• Horn/probe contact surfaces</li> <li>• Horn/probe threads</li> <li>• Probe radiation surface</li> </ul> </li> </ul>
011	No return signal from USC, USC or probe defective	
012	Error in frequency scan, no resonance frequency found, probe defective	If needed, replace the USC/probe and then check its function. Use the "probe check" or "scan frequency" functions for this purpose. After successfully completing the frequency scan, do not restart operation until initialization is complete. In the event of failure, contact BANDELIN.
014	Permissible internal operating temperature exceeded, ultrasonic homogenizer switches off	Allow the ultrasonic homogeniser to cool down for at least 10 minutes, if necessary check with a temperature sensor that the operating temperature of the GM has dropped to < 50 °C.

Error no.	Possible cause	Remedial action
020	Unknown command (communication error), remote control command was not executed or ignored	Observe the application information "Protocol and command set for remote control" and check commands.
021	Incorrect command length (communication error), remote control command was not executed or ignored	
022	Unknown type (e.g. probe)	Check USC, standard/booster horn and probe for compatibility.

### General device errors

Error	Possible cause	Remedial action
Device cannot be switched on? (display without function)	No power Mains cable loose or faulty?	<ul style="list-style-type: none"> <li>- Check that plug connection is firmly in place.</li> <li>- Check the cable for continuity or, if needed, exchange the mains connector.</li> </ul>
	Device fuse tripped?	<ul style="list-style-type: none"> <li>- Replace fuses. The fuses are located in the mains socket on the rear side of the generator, see chapter 1. (2 fuses: F2A)</li> </ul>
	Main fuse faulty?	<ul style="list-style-type: none"> <li>- Replace main fuse.</li> </ul>
Little or no ultrasonic power?	Is the connection from the ultrasonic converter to the standard/booster horn, or from the horn to the probe not secure?	<ul style="list-style-type: none"> <li>- Using the tool supplied, separate parts from one another, clean the surfaces, and firmly screw together once again, see chapters 4.3.1 ... 4.4.</li> </ul>
	Standard/booster horn or probe faulty?	<ul style="list-style-type: none"> <li>- Check the horn, probe and threaded pins for cracks, remove and replace if necessary. ⇒ Ensure that the surfaces are clean and smooth, see chapter 4.3.1.</li> </ul>
	Check for erosion on the titanium flat tip / probe - see chapter 5.1.	
	slight?	<ul style="list-style-type: none"> <li>- Polish the titanium flat tip and/or probe.</li> </ul>
	some pitting?	<ul style="list-style-type: none"> <li>- Grind or mill the titanium flat tip and/or probe until flat (max. 1 mm).</li> </ul>
	heavy?	<ul style="list-style-type: none"> <li>- Replace the titanium flat tip and/or probe with new ones.</li> </ul>
	Has liquid seeped in between the standard/booster horn and the probe?	<ul style="list-style-type: none"> <li>- Dismount the probe, clean the mounting surfaces and threads, dry and check for evenness, remount the probe and tighten, see chapter 4.3.1.</li> </ul>
	Is the threaded pin attachment on the titanium flat tip defective?	<ul style="list-style-type: none"> <li>- Replace the titanium flat tip, see chapter 4.3.1.</li> </ul>
	Is the threaded bolt on the standard/booster horn cracked?	<ul style="list-style-type: none"> <li>- Disassemble the parts, check the threaded bolt, replace if necessary, reassemble the parts, see chapter 4.3.1.</li> </ul>
Wrong resonance frequency?	<ul style="list-style-type: none"> <li>- Conduct frequency scan, see chapter 6.2 (search frequency).</li> </ul>	

Error	Possible cause	Remedial action
Significant heating in the vicinity of the mounting surfaces between the ultrasonic converter and standard/booster horn or between the standard/booster horn and probe?	<p>Sonicated parts (standard/booster horn and probe) not mounted firmly enough?</p> <p>Are mounting surfaces of the sonicated parts soiled?</p>	- Dismount the respective parts, clean the surfaces and firmly retighten, see chapter 4.4.

If it is not possible to rectify the fault using these short instructions, please contact your local specialist dealer or write us to the following address.

## 6.4 Repairs and service

If you identify errors or defects that cannot be rectified, the homogeniser may not be used. In such a case, please contact the supplier or the manufacturer in writing and use the enclosed questionnaire:

BANDELIN electronic GmbH & Co. KG  
 Heinrichstrasse 3-4  
 12207 Berlin

Repairs/Maintenance Department:  
 Phone: +49-(0)-30 – 768 80 – 13  
 Fax: +49-(0)-30 – 76 88 02 00 13

E-mail:  
[info@bandelin.com](mailto:info@bandelin.com)

In the case of returns, the general terms of delivery of BANDELIN electronic GmbH & Co. KG shall apply.

In addition, the homogeniser must be cleaned and decontaminated (if necessary), see the following chapter.



### Caution

- Only allow repairs to be conducted by authorised skilled personnel!
- Before each repair, turn off the device and disconnect the plug from the mains!
- Defective parts may only be replaced with original parts.
- The black housing of the ultrasonic converter and the aluminium cylinder (ultrasonic oscillating system) must not be twisted toward each other. The ultrasonic oscillating system and its electrical connections would be damaged as a result.

## 6.4.1 Decontamination certificate

If the homogeniser (with accessories, if applicable) is sent back to the manufacturer for repairs, the form "Certificate of Decontamination" must be filled out and affixed to the packaging on the outside, in a visible spot.

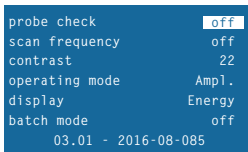
If this form has not been filled out, we reserve the right to refuse receipt of the package in order to protect our employees.

The form can be downloaded from the Internet as a PDF file:  
[www.bandelin.com/downloads ...](http://www.bandelin.com/downloads ...)

## 6.4.2 Software version display

In some cases it may be necessary to inform authorised skilled personnel or the manufacturer of the software version for the homogeniser.

The software version will be displayed in the menu "Miscellaneous functions and settings" (see chapter 3.2.4).



```
probe check      off
scan frequency  off
contrast        22
operating mode   Ampl.
display          Energy
batch mode       off
03.01 - 2016-08-085
```

The software version provided here is only an example, the actual specifications may differ.

## 7 Accessories

The proper accessories facilitate use of the ultrasound and protect at the same time the device and the materials used.

BANDELIN offers a broad range of accessories, see product information.

Additional information may be obtained from our supplier, our sales representatives, or from our website.

Telephone consultation:  
+49-(0)-30 – 768 80 – 0

Website:  
[www.bandelin.com](http://www.bandelin.com)

### 7.1 Required accessories

In order to mount / dismount standard/booster horns or probes, only use the tools specified in appendix A.

### 7.2 Optional accessories

#### Stand

Stands are used for correct, variable positioning of the ultrasonic converter.

Only ultrasonic converters, and not oscillating elements such as standard/booster horns with probes, may be affixed to the special holder.

An adapter ring AH 50 is required for the UW 50 (supplied in delivery).



#### Sound proof box

The sonication of liquids generates noise. The sound proof box mutes the sound emission up to approximately 30 dB(AU)



LS 40

## Ultrasonic converter / standard / booster horns

The following ultrasonic converters and standard/booster horns may be connected to the ultrasonic generators:

Ultrasonic generator	GM 4200			GM 4400	
Ultrasonic converter	UW 50	UW 100	UW 200	UW 200	UW 400
Standard/ booster horn	- - -	SH 100 G	SH 200 G	SH 200 G	SH 400 G

## 8 Consumable materials

No consumable materials are available for this ultrasound application.

## 9 Taking the unit out of service

The device must be disposed of appropriately, not with household waste.

Disposal must be conducted in accordance with the Waste, Electrical and Electronic Equipment Directive 2012/19/EU.

Any supplementary/deviating regulations must be observed.



- The device must be decontaminated before disposal. It can then be disposed of as electronic waste. If decontamination is incomplete / cannot be correctly performed, a material safety data sheet for the liquids used must be affixed to each device.
- Metal accessories such as probes or standard horns should be decontaminated and disposed of as metal waste.
- The packing is recyclable.



## 10 Key words

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## A Tools for mounting/dismounting

Probes and standard/booster horns are highly-sensitive parts that must be mounted and dismantled with the greatest amount of care.

For this reason, only use the following spanners for the mounting/dismounting of probes from standard/booster horns, as well as of standard/booster horns from the ultrasonic converter:

Spanner Type	Use
Spanner MS 10, long 	To mount/dismount probes UW 50 / SH 100 G / SH 200 G
Spanner MS 22 	To mount/dismount probes to SH 400 G
Sickle spanner HS 25/28, long 	To hold the UW 50 firmly in order to mount or dismantling the probes
Sickle spanner HS 40/42 	To mount/dismount probes (used to hold the SH 100 G / SH 200 G)
Sickle spanner HS 40/42, long 	To mount/dismount standard/ booster horns from the ultrasonic converter SH 100 G / SH 200 G / TH 100 G / TH 200 G / FZ 5 G / FZ 7 G
Sickle spanner HS 45/50, long 	To hold the SH 400 G
Torque Wrench DMS 10 	Code No. : 3662

**Important:**

The Instructions for Use in this and other languages, as well as further information, can be found on the enclosed CD.