A Geno Technology, Inc. (USA) brand name

Ultrasonic Cell Disruptor

Cat. No. BT2401

1-800-628-7730 ♦ 1-314-991-6034 ♦ info@BTLabSystems.com

Thanks for choosing BT Lab Systems Ultrasonic Cell Disruptor. This operation manual describes the function and operation of the instrument. For proper use and to avoid any serious injuries, please read this manual carefully before operating the instrument.

IMPORTANT SAFETY INFORMATION

- This product is an indoor instrument which conforms to Standard B style- I type- GB9706.1
- These units are designed for laboratory use by people knowledgeable in safe laboratory practices.
- The operator should never open or repair the instrument. Opening or repairing the instrument will void the warranty and can cause accidents.
- Make sure the rated electrical outlet load is no lower than the demand. Power cord should be replaced with the same type if it is damaged. Make sure there is nothing else on the power line. Hold the jack when pulling out the power line. Do not pull the power line. Do not put the power line in a place where there is a tripping hazard.
- The instrument should be used in an area with low humidity, little dust, away from water, direct sunlight, and any strong light source. Area should have strong ventilation without corrosive gases or strong magnetic fields. Keep away from stoves and all other heat sources.
- Power off when not in use. If the instrument will not be used for a long period, unplug, and cover to protect it from dust.
- In case of the following, unplug the instrument at once and contact BT Lab Systems.
    - The instrument encounters liquid.
    - The instrument gets soaked or burned.
    - The instrument emits an abnormal sound or smell.
    - The instrument is dropped or the outer shell damaged.
    - The instrument functions abnormally.

MAINTENANCE

Regular maintenance can ensure optimal performance and maximize the life of the Ultrasonic Cell Disruptor.

Instrument Maintenance

Use a dampened cloth with water and a mild detergent to clean the surface of the instrument. Do not let water get inside the unit.

Allow the instrument to dry before use.

Inspect the unit regularly for any signs of wear or damage. Contact BT Lab Systems for replacement parts immediately to avoid underlying issues worsening.

When not in use, store the instrument in a dry and cool location to prevent moisture buildup.

Horn Erosion

Due to cavitation corrosion and usage over a long period, the ultrasonic horn will become rough, and a honeycomb shape appears. Use a file or oil stone to flatten and smooth, otherwise the effectiveness of the horn will decrease. An eroded tip can also introduce metal particles causing the solution to become discolored. If the ultrasonic waves are not generating normally, use the horn selection switch to change the settings until the ultrasonic waves are normal.

Proper maintenance of the homogenizer horn can assist in longevity.

- Rinse with distilled water and allow to dry after every use to prevent any material buildup.
- Do not power on the instrument until the horn is immersed in the sample.
- Do not let the horn touch the walls of the sample container.
- When there is a significant amount of erosion, a replacement horn is necessary.

INTRODUCTION

The Ultrasonic Cell Disruptor is a multi-functional and multi-purpose instrument that uses ultrasonic waves to produce cavitation in liquids. It can be used for cell lysis, creating emulsions, mixing, dissolving, dispersing nanoparticles, defoaming, cleaning, and for accelerating chemical reactions. This instrument is widely used in scientific education, research, production, in the fields of biology, microbiology, physics, zoology, agronomy, and pharmacy.

FEATURES

- Novel and unique appearance. The use of this instrument is simple and convenient.
- 5” TFT color touchscreen to display various parameter indexes. Parameter setting is quick and easy.
- Horn height can be adjusted making this unit more compatible with various containers and liquid height levels. The program memorizes the last saved adjustment settings, saving time and effort.
- Soundproof box is designed with sound-absorbing cotton and magnetic rubber to reduce noise being emitted during cavitation process.
- Using ARM microcomputer technology, the instrument is finely adjustable.
- 9 groups of commonly used parameter settings can be stored in the program. One-key calling for convenience and efficiency.
- Equipped with an automatic alarm function to activate when time has ended and for over-temperature and overload faults.
- A UV lamp is used inside the soundproof box, which can sterilize and illuminate. Door lock handle integrated for safety.

TECHNICAL SPECIFICATIONS

Normal Operating Conditions

- Ambient Temperature: 4°C – 45°C
- Relative Humidity: ≤70%
- Power Supply: AC110V/ AC220V, 5A, 50/60Hz

Basic Parameters

Model	BT2401
Frequency	20-25KHz
Display Method	5" TFT Touch Screen
Supplied Horn	Φ6
Optional Horns (purchased separately)	Φ2, Φ3, Φ6, Φ10, Φ12
Process capacity*	0.5 – 500ml
Adjustable protection temp.	Sample temp. to 80°C
Max. lifting distance of horn	120mm
Alarm	Time, overload, over temperature
Input Power	AC110V/ AC220V, 50/60Hz
Power	650W (1% – 99%)
External Temp. Sensor	Included
Ultrasonic Time Setting	0.1 sec – 9.9 sec (Recommended: 1 – 4 sec)
Timer	1 sec – 99H:59M:59S
Interval Time Setting	0.1 sec – 99.9 sec (Recommended: 2 – 8 sec)
Fuse	250V, 5A, Φ5x20
Controller Dimensions (W x D x H)	250 x 420 x 438.5mm
Soundproof box Dimensions (W x D x H)	501 x 380 x 577mm
Net Weight	14kg

** Volume depends on the installed horn.*

Optional Horn Specifications

BT Cat. #	BT2401-A	BT2401-B	BT2401-C	BT2401-D	BT2401-E
Horn Size (mm)	Φ2	Φ3	Φ6	Φ10	Φ12
Process capacity	0.5 – 5ml	3 – 10ml	10 – 100ml	100 – 400ml	200 – 500ml
Power Ratio	1 – 25%	5 – 35%	35 – 70%	50 – 95%	55 – 99%

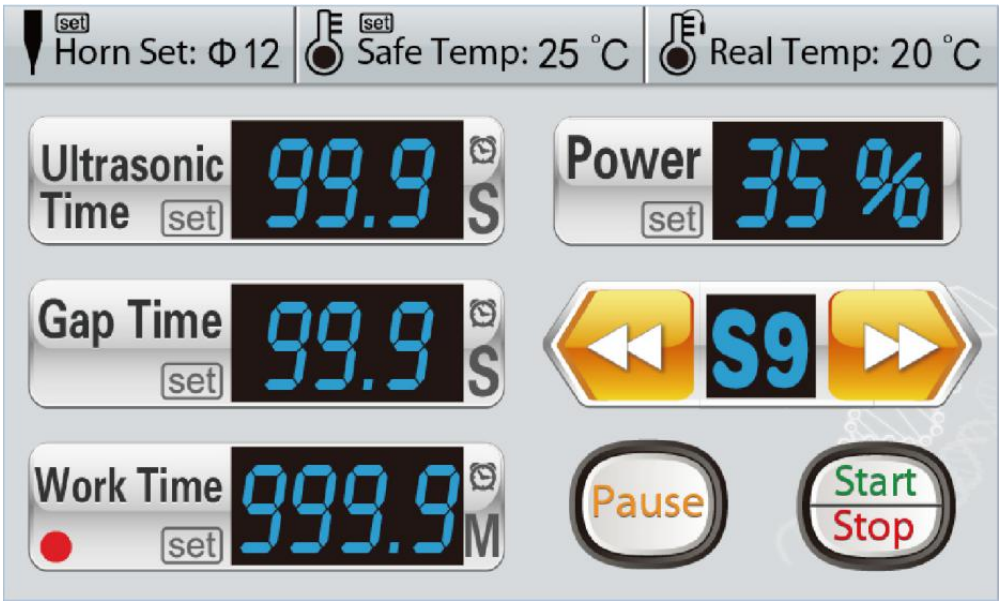
Different size horns can be purchased separately.

STRUCTURAL OVERVIEW

The instrument is composed of an ultrasonic generator (power supply), transducer components, and a soundproof box. The generator and soundproof box are connected by a cable. The structure and key functions are covered in this section.

Ultrasonic Generator

Ultrasonic Generator Operation Panel Display



Parameter Settings and Key Functions

Set the **Ultrasonic Time**

1. Press on the window where the values are displayed. The parameter block will change to orange indicating the switch to Edit Mode.
2. Use the adjustment knob to reach the desired value.
3. Press on the window where the values are displayed again to save.

Set the **Gap Time**

1. Press on the window where the values are displayed. The parameter block will change to orange indicating the switch to Edit Mode.
2. Use the adjustment knob to reach the desired value.
3. Press on the window where the values are displayed again to save.

Set the **Working Time**

1. Press on the window where the values are displayed. The parameter block will change to orange indicating the switch to Edit Mode.
2. Use the adjustment knob to reach the desired value.
3. Press on the window where the values are displayed again to save.

Set the **Power**

1. Press on the window where the values are displayed. The parameter block will change to orange indicating the switch to Edit Mode.
2. Use the adjustment knob to reach the desired value.
3. Press on the window where the values are displayed again to save.

Set the **Temperature Control**

1. Press on the window where the values are displayed. The parameter block will change to orange indicating the switch to Edit Mode.
2. Use the adjustment knob to reach the desired value.
3. Press on the window where the values are displayed again to save.

Real-time Temperature
Displays the real-time temperature of the test solution.

Horn Switch Display
Displays the current horn gear setting that corresponds with the Horn Selection Switch.

<u>Should be consistent with the size of the installed horn.</u>

Group Selection
Select from 9 sets of stored programs to run in real time.

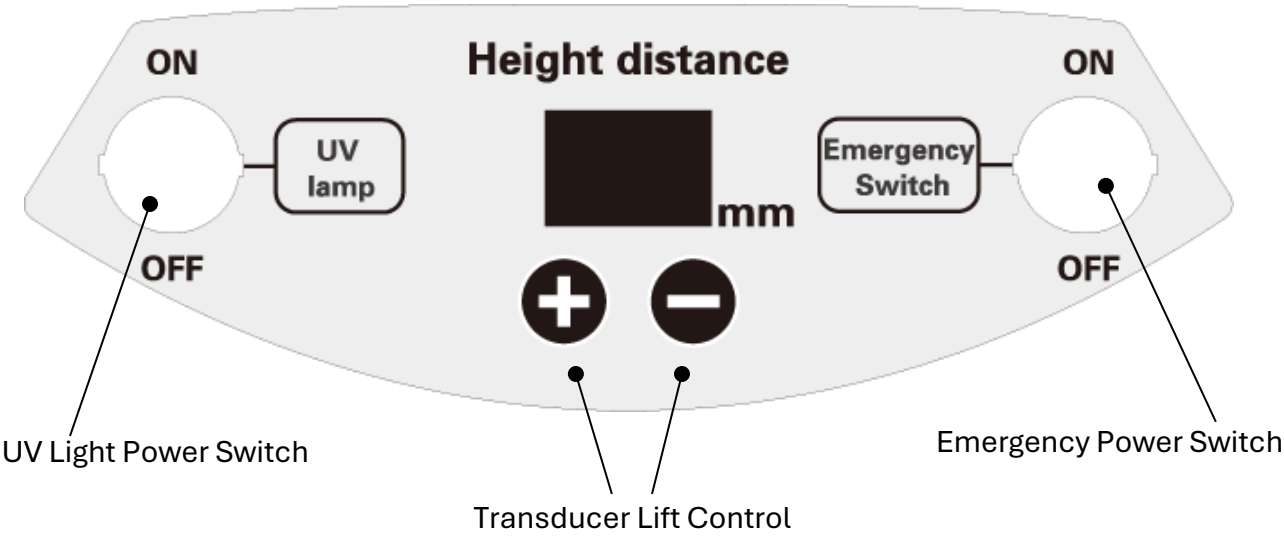
Note: When the horn selection is changed, the Power will reset to the default level for selected horn.

Pause and Start/Stop
Press the **Start/Stop** key to start and stop operation.

Press the **Pause** key during ultrasound to pause operation, then press the **Start/Stop** key to continue.

Soundproof box

Soundproof box Panel Display



Press to move the transducer apparatus up.
As the lift rises, the stroking distance will decrease.
Once the lift has reached the top, the distance value will be zero.

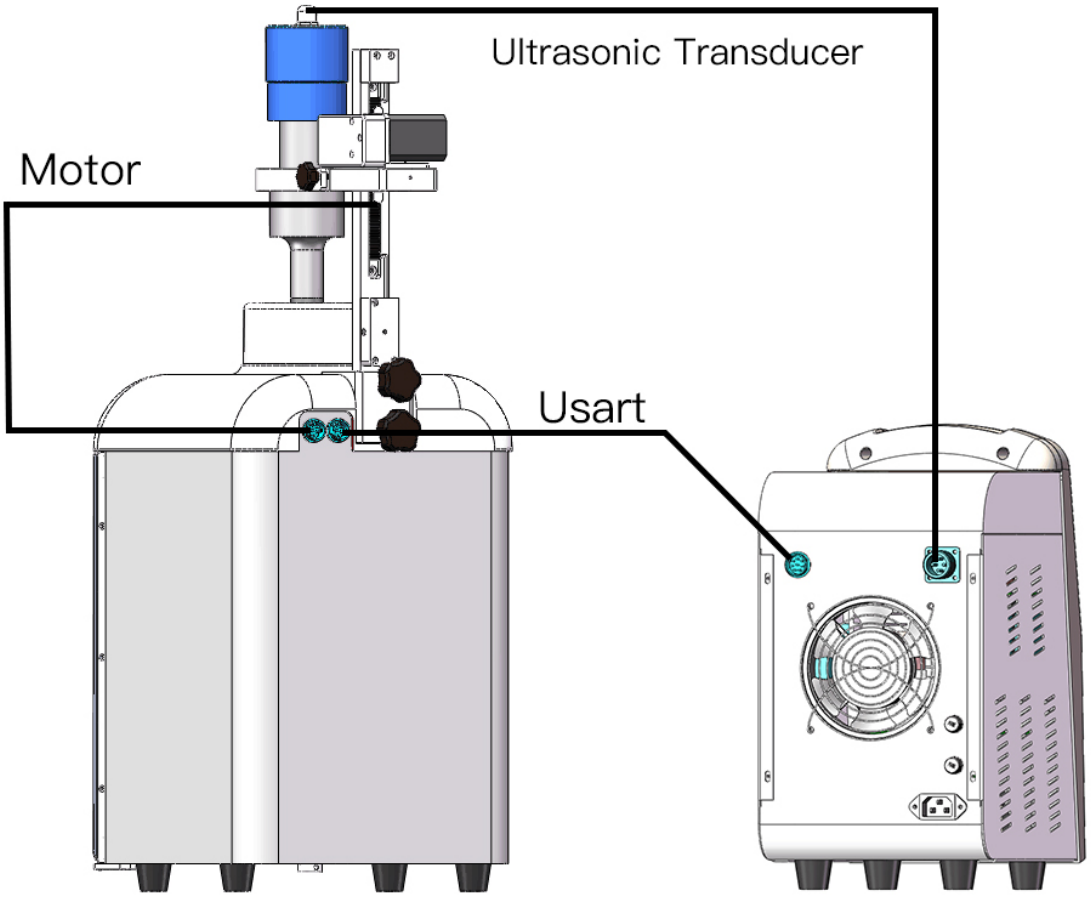
Press to move the transducer apparatus down.
As the lift descends, the stroking distance will increase.
The lift will stop once it has reached the maximum stroke value.

Alarm System

The instrument will set off an alarm to indicate the current situation using the below methods.

- Ultrasonic time has ended – buzzer will sound 3 times.
- Overload or Over-temperature – buzzer will sound 5 times.

External Wiring Diagram



PRECAUTIONS AND NOTES

1. Confirm the wiring is correct before starting the instrument up. Incorrect assembly of the cables and wires can cause the device to short circuit.
2. It is strictly prohibited to start the device when the horn is not inserted into the liquid (no load), or the tip is exposed in the air. This can damage the ultrasonic generator or transducer.
3. The user determines the amount of cell crushing, length of time, and power to use for optimal results according to different cells.

   The output power of a newly purchased instrument with a new horn will be higher. Therefore, the power should be adjusted to a lower setting to avoid an overload and damage to the horn.
4. The machine does not need to be preheated, but it should be very well grounded.
5. Due to the cavitation effect during crushing, the temperature of the liquid will quickly rise. Users should pay close attention to the temperature for various cells. It is recommended to use multiple short time crushing (no more than 5 seconds each time) and an ice bath cooling.
6. The instrument adopts switching power supply without industrial frequency transformer. Do not touch after opening the generator casing to avoid electric shock.
7. Through proven practices, the effects of multiple short time operations with working time of 1-4 seconds and interval time of 2-8 seconds, is better than that of continuous long-time operations.
   To prevent the liquid from heating up, longer interval times can be set.
   In addition, continuous long-time operations are prone to idling which shortens the life of the instrument.

Horn Selection Switch

The horn selection switch is used to match the frequency and resistance of different specifications of horns and generators. If the frequency of the transducer apparatus is inconsistent with the resistance of the generator, the ultrasonic wave cannot be generated.

1. When a new horn is equipped, the horn selection switch should be set to the corresponding gear position.
2. When the horn is worn, the switch can be toggled until normal ultrasonic wave is achieved. During this time, the position of the horn switch may not correspond with the size of the actual horn installed.

INSTALLATION AND OPERATION

Refer to the External Wiring Diagram for proper socket identification and connection.

1. Connect the power cord to the ultrasonic generator. **Make sure the power is switched OFF.**
2. Insert the unattached cable into the USART socket of the generator and soundproof box.
3. Connect the transducer cable to the ultrasonic generator socket.
4. Place the control cable for the motor of the lift bar into the soundproof box socket.
5. Ensure the clamp on the lift bracket that is holding the transducer is secure, then place the transducer apparatus into the opening on top of the soundproof box. Secure the lift bar to the soundproof box with the screw knobs.

Software application

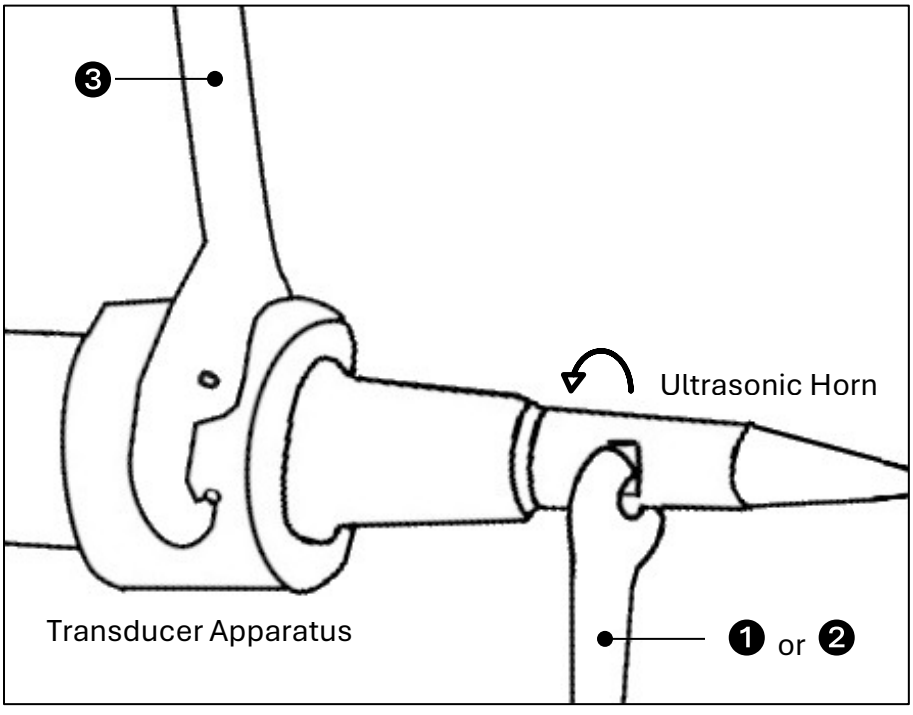
1. Place the container on the lifting platform inside the soundproof box.
2. Adjust the height of the platform. Everything should be center aligned. **DO NOT TOUCH THE BOTTOM OR WALLS OF THE CONTAINER.**
3. After sample placement is complete, turn on the power switch located behind the ultrasonic generator. When powered on, the transducer apparatus will rise to the top starting point.
4. Set the desired parameters and check for correct horn selection.
5. For the first operation, adjust the height of the transducer using the Transducer Lift Control Keys. The horn should enter the liquid 10-20mm beneath the liquid surface.
6. Start the operation from the ultrasonic generator. When the operation is complete, the transducer apparatus will return to the top starting position.
7. When powered off, the transducer apparatus will descend to the last height setting used.

Horn Disassembly

The unit is supplied with one open-end wrench[1] and two c-pin hook spanner wrenches (small[2] and large[3]) for disassembling and reassembling the horn.

- Wrench 1 is used to loosen and tighten horns Φ2 and Φ3.
- Wrench 2 is used to loosen and tighten horns Φ6, Φ10, and Φ12.
- Wrench 3 is to keep a firm hold on the transducer apparatus when loosening or tightening the horn.

1. Power off the instrument and remove the transducer apparatus from the soundproof box.
2. Lay the top end of the transducer apparatus on soft material.
3. Place the large hook spanner wrench[3] into the pin holes on the transducer with the handle facing away.
4. Using the correct wrench[1/2], place it on the notch of the horn.
5. With the large hook spanner wrench[3] in the left hand and the other wrench[1/2] in the right hand, push in a downward direction, turning the horn counterclockwise to loosen.
6. Turn the horn clockwise to tighten. The horn must be tight and secure prior to returning the transducer apparatus to the soundproof box.



REFERENCE DATA

The following examples illustrate the experimental data of some samples when using a Φ6mm horn.

Experiment content	Ultrasonic time	Gap time	Working time	Ultrasonic power	Container	Breakage rate
Pseudomonas Aeruginosa	2s	3s	5-10m	65%	50ml	>92%
Mouse liver	2s	3s	10-15m	55%	20ml	>92%
staphylococcus	1.5s	2s	15-20m	45%	20ml	>90%
Escherichia coli	2s	3s	10-15m	65%	50ml	>93%
Rat sciatic nerve	1.5s	2s	10-15m	55%	20ml	>92%
Treponema pallidum	1.5s	2s	10-15m	45%	20ml	>90%
Liver cell enzyme extraction	2s	3s	5-10m	55%	30ml	>95%

TROUBLESHOOTING

Issue	Analysis	Troubleshooting
The display does not light up after switch the power on	Power is not turned on	Check the power cord is plugged in and switch is set to on
	Power switch is damaged	Exchange power switch
	Other	Contact BT Lab Systems
The Soundproof box panel interface displays “ERR”	Cable between the transducer assembly and host is not plugged in properly	Confirm cable is in correct socket, firmly inserted and tightened
Transducer is not working properly	Over temperature protection	Adjust the temperature control setting
	Overpower protection	Turn down the ultrasonic power and restart
	Improper horn switch selection	Turn the horn selection switch to the corresponding gear
	Other	Contact BT Lab Systems
Horn selection switch does not work	Horn selection switch is damaged	Contact BT Lab Systems
Parameter adjustment knob does not work	Knob is damaged	Contact BT Lab Systems

WARRANTY

Our company guarantees that this unit is warranted against defective material and workmanship for a period of one year from the date of shipment. We will repair or replace the defective equipment returned during the warranty period free if the equipment has been used under normal laboratory conditions and in accordance with the instruction in this manual. The following defects are specifically excluded:

1. Damage caused by accident, misuse, or abuse.
2. Damage caused by disaster.
3. Repair or modification by anyone else without our authorization.
4. Corrosion due to the use of improper solvent or sample.
5. Defects caused by improper operation.
6. Use of fittings or other spare parts supplied by different manufacturers.

This warranty does not apply to platinum wire and all the accessories.

A return authorization must be obtained from us before returning any product for repair on a freight prepaid basis.

For any inquiry or request for repair service, please contact BT Lab Systems via the email below.

E-Mail: info@BTLabSystems.com

TECHNICAL SUPPORT

BT Lab Systems offers technical support for all its products. If you have any questions about the product's use or operation, please contact BT Lab Systems at the following info.

E-Mail: info@BTLabSystems.com