PIXUL™ Multi-Sample Sonicator

Catalog No. 53130

(version A6)

PIXUL™ Multi-Sample Sonicator
powered by Matchstick Technologies

PIXUL™ is sold under an exclusive license to patents owned by Matchstick Technologies Inc. and University of Washington, specifically Matula, T.J.; Bomsztyk, K.; Darlington, G.P., Maxwell, A.D.; MacConaghy, B.E., Reed, J.

"Ultrasound system for shearing cellular material". US Patent US10809166. European Patent EP3169451.

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Active Motif Limited Warranty

Active Motif warrants that the PIXUL Multi-Sample Sonicator will be free from defects for 12 months from the date of delivery when used under normal working conditions and in accordance with manuals and other documents. Any component that proves defective during this period will be repaired or replaced at no cost to the purchaser. Active Motif will provide a shipping container and instructions for the customer to return the instrument for repair or replacement. All shipping charges during the warranty period will be paid by Active Motif. In the event of a warrantable defect, please contact Active Motif for a return authorization and instructions prior to returning any instrument or parts.

The warranty is void if failure of the instrument or parts, including all firmware or hardware, has resulted from accidents, abuse, improper maintenance, usage, or repair, or misapplication by the customer. It is also void if damage is cause by any unauthorized modifications made to the instrument.

The warranty is limited to repair or replacement only, is not transferable, and is available only to the original purchaser.

The warranty is void if the instrument is run without Active Motif Coupling Fluid (cat. no. 53136) in the cooling reservoir. Coupling Fluid not only acts as the cooling liquid, but is also required for the transmission of energy from the transducers to solution in the wells. Failure to run the instrument without Active Motif Coupling Fluid will damage the transducers.

The warranty is void if the instrument is run without the proper plate (cat. no. 53139) or without liquid/water in every well of the columns in the 96-well plate that are being sonicated. Permanent damage to the transducer and electronic circuits could result if the transducer is operated without liquid/water in every well of the columns in the 96-well plate that are being sonicated.

Except as otherwise stated above, Active Motif's standard Terms and Conditions apply. See www.activemotif.com/terms-conditions for more information.

Information in this manual is subject to change without notice and does not constitute a commitment on the part of Active Motif, Inc. It is supplied on an "as is" basis without any warranty of any kind, either explicit or implied. Information may be changed or updated in this manual at any time.

The manufacturer of this documentation is Active Motif, Inc.

General Warnings

Don't run the PIXUL™ Multi-Sample Sonicator without PIXUL Coupling Fluid (Cat. No. 53136).

If low pressure error message appears on PIXUL screen, please stop the run, power off, remove plate, close lid, and contact Active Motif. DO NOT continue to run PIXUL bypassing the message under any circumstances.

Tilting the PIXUL instrument can result in spillage of Coupling Fluid.

Do not unplug or power off the PIXUL instrument during a run. Loss of power to the instrument while a file is open can result in corruption of the data file and operating system.

Coupling Fluid must be carefully monitored. If changes in Coupling Fluid transparency, color, or texture are observed, power off the instrument, drain Coupling Fluid completely, and replenish with fresh Coupling Fluid. It is recommended to change PIXUL Coupling Fluid every 2 months.

Running the PIXUL unit with no/low Coupling Fluid OR low pressure error will damage the PIXUL device.

PIXUL Coupling Fluid temperature should be approximately 15°C at the start of the sonication run. Don't exceed a Coupling Fluid temperature of 35°C during sonication. If Coupling Fluid temperature is maintained within this range, in-well thermal monitoring indicates that the temperature of the sample is within the normal range experienced by samples in all major sonication instruments (please see referenced publication #1 on page 16).

Only use room temperature (not previously frozen) 96-Well PIXUL Plates (Cat. No. 53139) with the PIXUL instrument. Place plates with well A1 in the upper left corner. All wells in columns being sonicated MUST be filled with fluid. Do not reuse plates from partial runs, as this can lead to issues with shearing consistency and sample contamination.

Don't lift the external lid during processing of samples. Lifting the external lid will stop the run, initiating drainage of PIXUL Coupling Fluid from under the plate, necessitating re-circulation of Coupling Fluid to start over from the beginning processing samples. The run will not resume from the point in time it was interrupted.

Any technical modifications to the device are prohibited. Service works may be carried out only by qualified personnel or under the supervision of qualified personnel.

Overview

Active Motif's PIXUL™ Multi-Sample Sonicator is a high-throughput instrument for mechanical shearing of DNA, RNA, chromatin, or protein from purified samples, cells, or tissue. This system utilizes ultrasound transducers to create focused ultrasonic waveforms, transmitted through PIXUL Coupling Fluid, to a 96-well microplate (cat. no. 53139). This flexible system allows for up to 12 unique sonication parameters (one for each column of wells) to be set in the 96-well plate, generating consistent and reproducible fragmentation profiles in just 10-30 minutes per plate, depending on sample type.

product	format	catalog no.
PIXUL™ Multi-Sample Sonicator	1-96 samples	53130

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Introduction

PIXUL™ Multi-Sample Sonicator

Next-generation sequencing applications, such as ChIP-Seq, RNA-Seq, RIP-Seq, exome, and whole genome sequencing, require precise sample fragmentation (200-600 bp) for compatibility with short read sequencing platforms. Shearing by mechanical sonication, as opposed to enzymatic methods, is preferred for its unbiased nature and ability to produce a relatively narrow fragmentation profile. However, the currently available sonication systems can be incompatible with high-throughput sample processing. The PIXUL Multi-Sample Sonicator provides a flexible and reproducible shearing profile for up to 96 samples processed in parallel.

Furthermore, high-throughput sonication on other platforms is currently limited by the cost of consumables (tubes, plates, and reagents). However, the low cost, round-bottom plates (Cat. No. 53139) used in the PIXUL instrument are compatible with cell culture and shearing, eliminating sample transfer steps that are inconvenient and can lead to loss of sample. Furthermore, the PIXUL Coupling Fluid does not require lengthy degassing and can be adequately circulated and ready for sonication in approximately 10 minutes.

Sonication of the samples is quick and easy. Using the touchscreen user interface, researchers are able to specify unique sonication parameters for each column of the 96-well plate, enabling processing of many sample types for many different applications in the same microplate. Most runs are complete within 10-30 minutes, ensuring that sample sonication will not be the bottleneck for your high-throughput applications.

Technical Specifications:

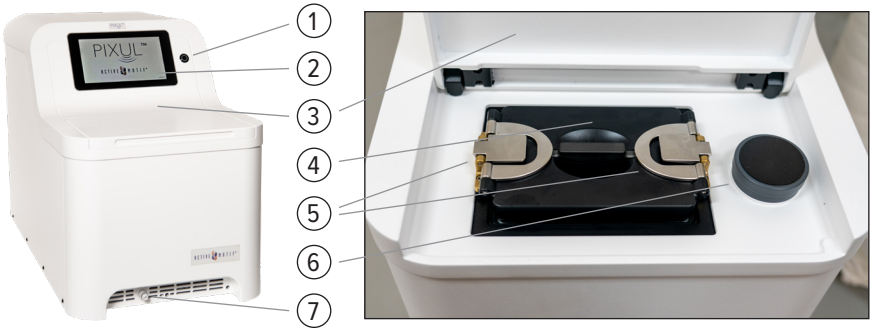
Dimensions (h, d, w)	45 cm x 59 cm x 34 cm (17.7 in x 23 in x 13 in)
Weight	23 kg (50.7 lbs)
Power Requirements	100-240 VAC, 50-60Hz, 6 A max. at 115 VAC, 700 W
Operating Environment	15°C to 25°C (59°F to 77°F), max. 85% relative humidity
Storage Temperature	5°C to 25°C (41°F to 77°F)
EMC	Complies with EN IEC 61326-1, "Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements", Class A. Complies with FCC Part 15 Class A and FCC part 18 radio emissions requirement for the USA and ICES-001 and ICES-003 for Industry Canada. Complies with EU EMC Directive 2014/30/EU. Additional information on page 20
FCC & IC Statement	Additional information on page 20
Safety Certification	UL Listing - certified to comply with UL #61010-1, 3rd Edition cUL Listing - certified to comply with CAN/CSA C222.2 No. 61010-1-12, 3rd edition. IEC 61010-2-081 . Particular requirements for automatic and semi-automatic laboratory equipment for analysis and other purposes CE Mark - complies with EN/IEC 61010-1 3rd edition. Under UI file # E513812-D1000
Operating System	User interface, software and processors are fully integrated into the instrument.
Chiller	Chiller is fully integrated into the instrument.
Sample Processing Capacity	Sample processing uses round bottom 96-well microplates (Corning Cat. No. 3799), 200 µL per well
Recommended Batch Size	1 to 96
Applications	DNA Shearing RNA Shearing Chromatin Shearing Protein Extraction

Included Accessories:

a. Drain Tube

b. Shipping Cap

PIXUL™ Multi-Sample Sonicator Exterior Components



1. **Main Power Button:** Press to turn on the PIXUL instrument. Power switch on back side of the PIXUL instrument must be turned on first.

2. **Touchscreen User Interface:** Will initiate once main power button is pressed. Use the touchscreen to circulate the PIXUL Coupling Fluid, select sonication parameters, monitor Coupling Fluid temperature, and monitor the time remaining for the run.

3. **Exterior Lid:** Lift to install sample plate. Lid must remain down during sonication run.

4. **Pressure Distribution Plate Cover:** Sits directly on top of the sample plate and is secured down with the latching mechanism.

5. **Latching Mechanism:** Once the sample plate has been placed with well A1 in the upper left corner and covered with the pressure distribution plate cover, push both levers with your thumbs or fingers to engage the latches and secure the plate prior to closing the exterior lid.

6. **Coupling Fluid Reservoir:** Lift cap to fill reservoir with PIXUL Coupling Fluid (approximately 0.5 L capacity). Add Coupling Fluid periodically to maintain the minimum level (about one inch below the top of the reservoir). Drain old Coupling Fluid and add new Coupling Fluid every two months.

7. **Drain:** To drain PIXUL Coupling Fluid from the Coupling Fluid reservoir, ensure that no plate is installed. Then, connect the drainage tubing to the drain. Coupling Fluid should begin to flow.

Installing the PIXUL Multi-Sample Sonicator

The following instructions detail the installation procedure for the PIXUL Multi-Sample Sonicator. Only attempt to install this instrument after reading these instructions.

No special tools are required for installation.

The PIXUL instrument is intended for indoor use, and the power plug must be grounded.

Place the PIXUL instrument on a level, non-slip surface with sufficient load bearing capacity. Do not place anything heavy on the PIXUL instrument.

Do not cover the ventilation openings. Provide at least 20 cm of clearance to allow proper airflow. Toxic vapors can be produced depending on the type of operation. Ensure sufficient extraction of the vapors.

1. Open the boxes and cut the shipping straps. Remove the molded styrofoam packaging, protective clear wrapping, and any tape securing moving parts. Inspect the instrument and accessories immediately after delivery for completeness and transport damage.

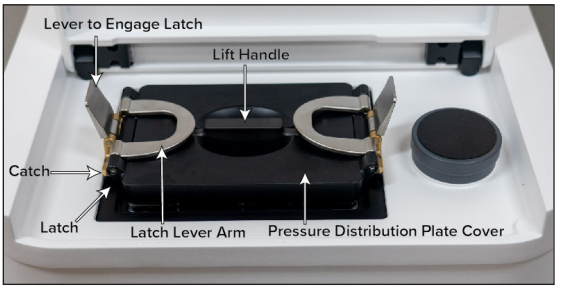
2. Place the PIXUL instrument on a bench. Always make sure the PIXUL is on a level surface.

3. Remove the Shipping Cap and save it. Fill the reservoir of the PIXUL instrument with approximately 0.5 liters of PIXUL Coupling Fluid. The fluid level should reach about an inch below the reservoir top. If you accidentally overfill the reservoir, wipe up any spilled Coupling Fluid and suction Coupling Fluid out of reservoir until it reaches the appropriate level. Cover the reservoir with the Black Running Cap.

4. Plug the power cord into the back side of the PIXUL instrument and the wall outlet.

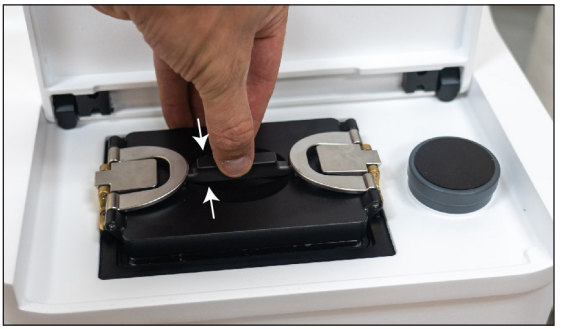
Installing Your Sample Plate

Diagram of Features.

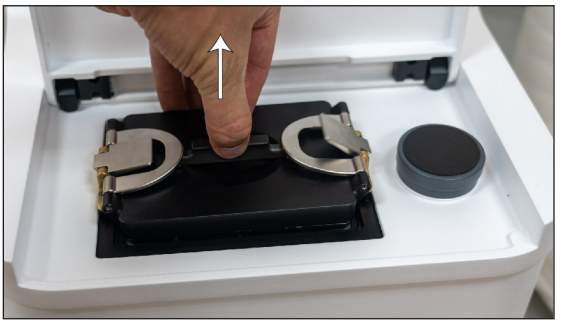


Grasp lid by Lifting Handle to remove Pressure Distribution Plate Cover.

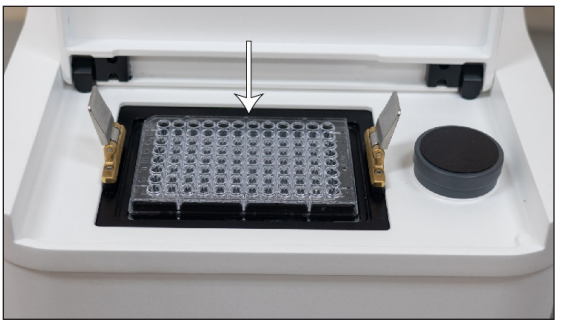
Do not pry the levers or latch up, the latching mechanism will disengage when the Lift Handle is lifted.



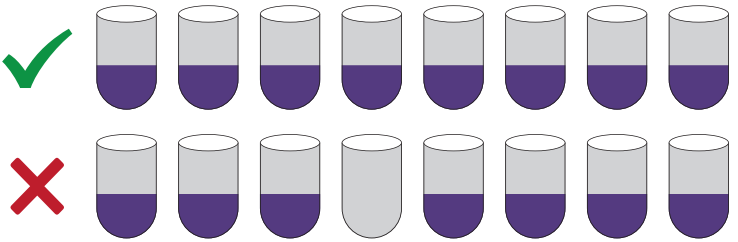
Lift to Remove.



Insert your plate.



Warning: A 96-Well PIXUL Plate (cat. no. 53139) should be mounted and secured prior to attempting to circulate the PIXUL Coupling Fluid. Load your samples into the 96-Well PIXUL Plate in the same orientation as will be indicated on the instrument touchscreen. Any wells lacking sample in the columns being sonicated MUST be filled with liquid (water or buffer).

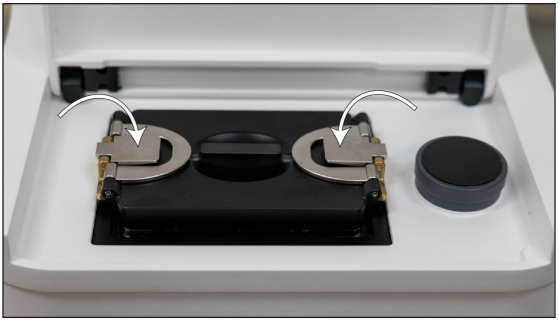


Be sure to seal the plate well with an adhesive plate seal to prevent the samples from spilling. Coupling Fluid should be circulated and allowed to cool to approximately 15°C prior to initiating sample processing.

Place the Pressure Distribution Plate Cover on top of Sample Plate.

Engage Latching Mechanism by pressing on both Levers with your thumbs or fingers to engage latch. There is no audible click.

Close the Exterior Lid. If the Pressure Distribution Plate Cover is improperly seated, the Exterior Lid will not close.



Operating the PIXUL Multi-Sample Sonicator

1. Ensure that the PIXUL Coupling Fluid level is about an inch (2.5 cm) below the reservoir top. Do not overfill.
2. Switch on the power switch on the back side of the PIXUL instrument.
3. Press the main power button on the front side of the PIXUL instrument. The touchscreen will start initializing.
4. Load your samples in the 96-well PIXUL plate (cat. No. 53139). 100 µl sample volume per well is optimal. Be sure to keep the outside bottom of the plate clean and free of lint or other debris. Load the sample-containing 96-Well PIXUL Plate (cat. no. 53139) into the PIXUL instrument. Lift the external lid, place the plate with well A1 in the upper left corner, secure down the pressure distribution lid on top of the plate with plate-securing rods, and close the external lid.

5. On the touchscreen, press Circulate to initiate PIXUL Coupling Fluid cooling. You cannot start the sonication run with out circulation active. You can monitor Coupling Fluid temperature in the upper right hand corner of the touchscreen.
6. On the touchscreen, select the plate columns for which you would like to set sonication parameters. Columns selected together will be outlined in the same color.
7. On the left side of the touchscreen, you can use the left and right arrows to select from saved presets of sonication parameters. You can also use the add and delete buttons to add or remove a row of process settings.

Adjust the following parameters (See Appendix, Section A for further details):

Pulse: The number of 2 MHz cycles per pulse

PRF: Pulse Repetition Frequency; the kHz frequency of pulse repetitions

Process Time: Time a given column is actively driven. Process timers for all columns run simultaneously, so the total run time for the entire plate is equal to the time of the column(s) chosen to have the longest process time. For example, a plate with the following column-associated process times will take a total of 21 minutes:

Columns	Process Time
1, 2 and 4	18 minutes
3, 6, 9, 10 and 12	12 minutes
5, 7 and 8	21 minutes
11	0 minutes

Burst Rate: The frequency with which the burst (a set of pulses) transitions from one column to the next; this parameter is always the same for all columns. We recommend using the following parameter specifications as a starting point, and adjusting Process Time to optimize for your specific sample and application:

Note: The software will not allow settings that could damage the transducers and the upper limits are a maximum Pulse of 50 or a maximum PRF of 1.00. We recommend a minimum Burst Rate of 20.00 Varying the Process Time is typically the only parameter that needs adjusting, with longer Time needed for difficult samples such as adipose tissue.

8. Once the PIXUL Coupling Fluid has reached approximately 15°C, press Start on the touchscreen. The time to completion will appear in the top left hand corner of the touchscreen.
9. Once the run has completed, open the external lid. PIXUL Coupling Fluid will drain from underneath the sample plate for the next few seconds.
10. Unload the sample plate by lifting the Pressure Distribution Plate Cover by the Lift Handle and simply pulling up.
11. To turn off the PIXUL instrument, press the main power button on the front side of the PIXUL instrument and switch the power switch off on the back side of the PIXUL instrument.

Sonication Parameter	DNA** (Cells & Tissue)	Chromatin** (Cells & Tissue)	DNA/RNA** (Purified)	Protein** (Cells & Tissue)
Pulse [N]	50	50	50	50
PRF [kHz]	1.00	1.00	1.00	1.00
Process Time	30:00	30:00	10:00 – 30:00	1.00 – 2.00
Burst Rate [Hz]	20.00	20.00	20.00	20.00

*Labile marks, like phosphorylated epitopes, may be preserved better by discontinuous sonication (e.g. rather than 30 minutes, 4 rounds of 4-6 minutes each, where the PIXUL Coupling Fluid is allowed to circulate and cool between runs).

**Please see our Quick Guides for additional details on sonication recommendations.

Maintenance

- Before all maintenance work, you should ensure that decontamination of the device has been performed if it came into contact with hazardous materials.
- Ensure all components of the PIXUL instrument are at room temperature before touching them.
- Before and after each use, wipe down the plate loading area with a damp cloth, and then dry. You may remove the external lid to aid in this cleaning.
- At daily intervals, inspect the drain plug by visual inspection from the outside.
- At monthly intervals, inspect the PIXUL Coupling Fluid, and clean the touchscreen with water and detergent. Do not use acetone or solvents as these may cause damage.
- At bimonthly intervals, PIXUL Coupling Fluid should be replaced.
  To drain Coupling Fluid, attach the drain hose to the drain on the front of the instrument and ensure that no plate is loaded into the instrument. Once the hose is attached, the Coupling Fluid will begin to flow. Be ready to capture draining Fluid in a waste collection container.
- When replacing PIXUL Coupling Fluid read and retain the SDS documentation which accompanies the fluid

Removal of equipment from use for repair or disposal

To ship the PIXUL, the Coupling Fluid must be drained, and the Shipping Cap that came with the instrument must be used as the cover for the Coupling Fluid Reservoir. There also must be a microplate in place and secured with the Latches engaged on the Pressure Distribution Plate Cover.

- Refer to the supplied SDS for further information on the Coupling fluid.
- Coupling fluid should be disposed of according to local regulations.

Disassembly Instructions

For WEEE materials and components removal procedures please contact Active Motif for instructions on how to return the instrument to the factory. Contact information is provided on the cover page of this document.

Tools Required

This equipment is built with metric hardware.

- Set of metric Allen wrenches
- Set of metric Torx wrenches
- Set of metric socket wrenches
- Set of standard and positron screw drivers

Material shipped into the EU are RoHS compliant 5/6 and are to be recycled according to regulatory requirements.

The transducer contains Lead and must be disposed of accordingly

Touchscreen Messages and Errors

Checking for microplate/No microplate detected – The PIXUL instrument ensures that a plate is loaded prior to commencing Coupling Fluid circulation or sonication run.

Removing fluid from microplate area – The PIXUL instrument automatically drains Coupling Fluid when the external lid is opened.

Unable to start processing. No columns are enabled. – The PIXUL instrument requires the Pulse, PRF, Process Time, and Burst Rate to be set for at least one column before the sonication run will initiate.

Circulation must be enabled before starting process. – On the touchscreen, Circulate must be pressed and the Coupling Fluid allowed to circulate and cool before processing will initiate.

Lid is open. Please close lid to continue. – The external lid must be shut before processing will initiate.

Low pressure – The pressure of the Coupling Fluid is insufficient to initiate a sonication run. Please stop the run, power off, remove plate, close lid, and contact Active Motif. DO NOT use PIXUL before we respond.

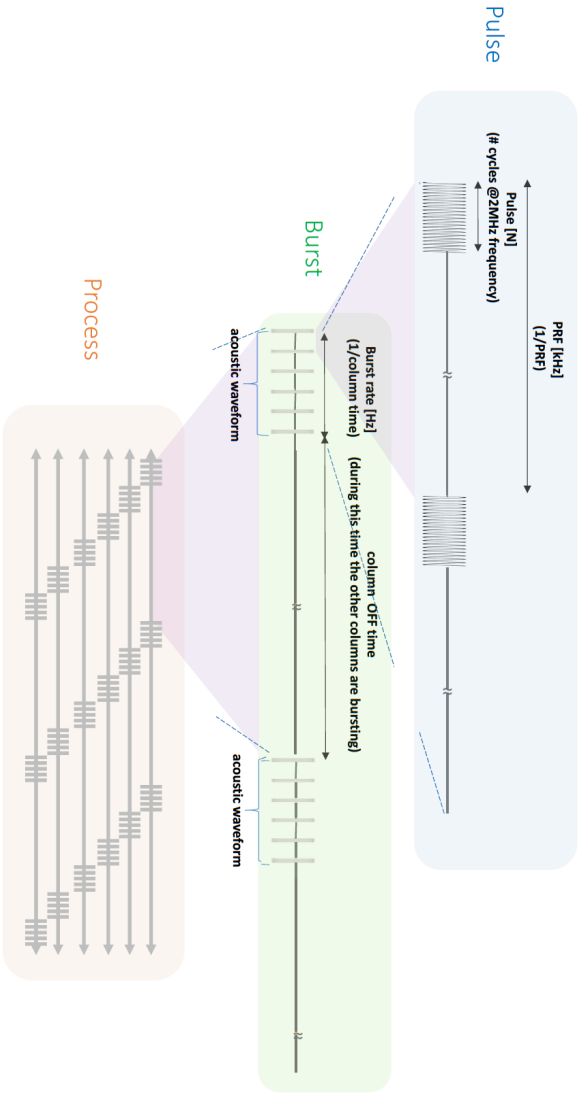
Touchscreen Messages:

- Unable to start processing. No columns are enabled
- Circulation must be enabled before starting process.
- Unable to communicate with device. Power off and on the system.
- Lid is open. Close lid to continue.
- Input parameter was invalid. Nearest valid value will automatically be selected.
- Power off and on the system.
- Checking for microplate.
- Removing fluid from microplate area.
- Low Pressure. pressure1 = 123 pressure2 = 123 If you see this error, please stop the run, power off, remove plate, close lid, and contact Active Motif. DO NOT use PIXUL before we respond.
- No microplate detected pressure1 = 123, pressure 2 = 123
- Temperature 239°C. Contact Active Motif for service instructions.

References

1. Bomsztyk, K., *et al.* (2019) *Nucleic Acids Research* 47(12): e69.
2. Kanter, J.E., *et al.* (2019) *J. Clin. Invest.* 129(10):4165-4179
3. Levy, S., *et al.* (2022) *Cell Reports* 38, 110457
4. Chapin, N., *et al.* (2022) *Communications Biology* 5:596
5. Hopf, A., *et al.* (2022) *Bioengineering* (Basel) 9(9):412

Section A. PIXUL Sonication Parameters Guide



Section B. Troubleshooting Guide

Problem/question	Possible cause	Recommendation
Instrument will not turn on.	No power is being supplied to the unit.	Check that the power cord is securely plugged into both the PIXUL instrument and wall plug.
	Unit hasn't been properly turned on.	Ensure that both the power switch on the back side and the main power switch on the front side of the PIXUL instrument are both turned on.
Sonication run will not start.	Coupling Fluid is not circulating.	Check to make sure that the Coupling Fluid has started circulating.
Samples do not sonicate as expected.	Plate is installed incorrectly.	Ensure well A1 of the plate is placed in the upper left corner.
	Samples are overheating.	Monitor the Coupling Fluid temperature and ensure that it does not exceed 35°C during sonication. Reduce the Pulse and/or PRF values if necessary.
	Samples are not diluted in appropriate sonication buffer.	Ensure that your sample is diluted in the recommended sonication buffer, as specified in Quick Guides and User Manuals. Consider running a positive control sample, available from Active Motif.
Low Pressure Error.	Clogged filter.	Please stop the run, power off, remove plate, close lid, and contact Active Motif. DO NOT use PIXUL before we respond. DO NOT continue to run PIXUL bypassing the message under any circumstances.

Section C. WEEE Statement

This symbol on the product(s) and/or accompanying documents means that used electrical and electronic equipment (WEEE) should not be mixed with general household waste.

Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.

Penalties may be applicable for incorrect disposal of this waste, in accordance with your national legislation.

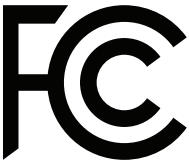
For professional users in the European Union

If you wish to discard electrical and electronic equipment (EEE), please contact your dealer or supplier for further information.

For disposal in countries outside of the European Union

This symbol is only valid in the European Union (EU). If you wish to discard this product, please contact your local authorities or dealer and ask for the correct method of disposal.

Section D. FCC & IC Statement



This device complies with Part 15 and Part 18 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This product may cause interference to radio equipment and should not be installed near maritime safety communications equipment or other critical navigation or communication equipment operating between 0.45-30 MHz.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to other equipment , which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna. —Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the factory and other product manufacturer or an experienced engineer for help.

Additional information on EMC for Canada

This ISM device complies with Canadian ICES-001
Cet appareil ISM est conforme à la norme NMB-001 du Canada.
This Class A device complies with Canadian ICES-003
Cet Clase A appareil est conforme à la norme NMB-003 du Canada.

Section E. Icon Legend

Icon	Description
	On (Power)
	Off (Power)
	On or partial off
	Alternating current
	Protective Conductor Terminal
	Earth (ground) terminal
	Operating Instructions
	Caution, consult user guide
	Manufacturer
#	Model Number
REF	Catalog Number
SN	Serial Number
	Do not dispose of in trash
	Biological risks

Technical Services

If you need assistance at any time, please call or send an e-mail to Active Motif Technical Service at one of the locations listed below.

Active Motif North America

Toll free: 877.222.9543
Direct: 760.431.1263
Fax: 760.431.1351
E-mail: tech_service@activemotif.com

Active Motif Europe

UK Free Phone: 0800/169 31 47
France Free Phone: 0800/90 99 79
Germany Free Phone: 0800/181 99 10
Direct: +32 (0)2 653 0001
Fax: +32 (0)2 653 0050
E-mail: eurotech@activemotif.com

Active Motif Japan

Direct: +81 (0)3 5225 3638
Fax: +81 (0)3 5261 8733
E-mail: japantech@activemotif.com

Active Motif China

Direct: (86)-21-20926090
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E-mail: techchina@activemotif.com

Visit Active Motif online at **activemotif.com**